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Water-chemical investigations in the Csongrád-Szeged reaches of the Tisza

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/Received on December 1st 1969/

Abstract

The paper is discussing some problems of the 10-year old experiences of water-chemical investigations carried out in the Csongrád-Szeged reaches of the Tisza. It gives a short characterization about the chemical composition of the water, the value of the major pollution indices and their most characteristic changes during the ten years.

This first publication is to be amplified later by elaborating a number of further details. A conclusion drawn from the technique and frequency of the water-chemical investigations is showing, at the same time, the direction of practice to be followed in this field in the future.

Introduction

The Laboratory of the Water Quality Control in the Water Management of the Lower Tisza Region has performed water quality investigations in the Csongrád-Szeged reaches of the Tisza for a decade, in the first years under control and supervision of the Scientific Research Institute for Economy of Water Supplies /Budapest/, and in the recent years under that of the Water Quality Control in the Centre of the Economy of Water Supplies of the National Water Office.

From present year, the results of our work are systematically available for the Committee of Tisza Research. And even, taking into consideration the purposes of this Committee, we are performing our systematic water-chemical investigations on the Tisza in closer connection with it.

In our first publication we should like to discuss some experiences of the investigations carried out so far, mainly which have exerted an influence on the systematic Tisza research from fundamental points of view, resp. which will influence its efficiency, in the future, too. We cannot think of elaborating all the data of investigations in the framework of a single monograph because we elaborated only in the second half year of 1966 more than 150 water samples from a single sample area.

Methods applied by the investigations

The investigations were carried out on the basis of methodics and Unitary Water-research Methods prescribed by the Scientific Research Institute for Economy of Water Supplies, resp. by the Council for Mutual Economical Assistance /COMECON/. The measurement of pH took place colorimetrically or with instruments, the determination of alkalinity alkaliacidometrically, with volumetrical analysis. The carbohydrate content was established by calculation, on the basis of the latter data. The determination of the total hardness, of calcium and generally sulphate ions, took place complexometrically in a buffered medium in the presence of eriochromeblack T. resp. of murexide indicator, and that of chloride ions argentometrically. The oxygen consumption of water was determined with Kubel-Thiemann's method, in an acidic medium with potassium permanganate and expressed in oxygen mg/l value. The dissolved oxygen was conserved in an alkali medium in the firm of manganese /IV/ hydroxide in the site of ampling, then it was determined iodometrically in the laboratory after being acidified. For determining the biochemical oxygen demand the same method was applied, the temperature of 5-day incubation being 20 °C. The dissolved salt-content was established by weighing after 100 ml filtered water being distilled and dried on 105 °C. For determining the sodium and potassium ions Z e i s s flame-photometer was used. For measuring the nitrate ions, we have applied the colorimetrical method / D u b o s c q / using brucine in a vitriolic medium. The dissolved carbon dioxide was measured on the spot at sampling. The determination of ammonia happenned similarly on the site at sampling, with the help of N e s s l e r 's reagent colorometrically.

The evaluation of water quality was carried out on the basis of the "Unitary Criteria and Norms of COMECON concerning Water Quality and Principle of Their Classification" /OVF 1964/. /I will discuss them in details in my next paper/.

Reaches investigated

The whole watershed area of the river Tisza is 157,186 sq. km /G o d a 1965/, the same till Szeged is 138,408 sq. km, from that the watershed area of the reaches investigated by us is 9,351 sq. km. At Szeged the highest water level was + 923 cm /April 15 th 1932/ and then the water output was 4000 cubic metre per sec. At the same place the lowest water level was -250 cm /October 10th 1946/, with 90 cubic metre/per sec. water outnut. There may be accepted as an authentic August water output of 85 p.c. 228 cubic metres per sec.

The primary water composition of the Tisza is determined by the soil of this large watershed area, by the composition of its fundamental rock and by its decaying processes. Here and there the quality of water is influenced by tributaries-taken into consideration in the watershed area. In its reaches, investigated by us, in the Great Hungarian Plain that is scanty in rainfall, there can be only the water output of Körös and Maros on principle which is suitable to change quality and composition of its water. The factors exerting a secondary influence on the composition are the natural or artificial pollutions going together with the human activity, for ex civilization, urbanization. Both the primary and the secondary compositions are, of course, considerably influenced among others by several - mainly

meteorological - factors. Among them are the water output, water temperature, duration of sunshine, as well.

The sites of sampling are as follows;

at Chongrád, above the mouth of Körös ..... /246 rkm/
below the mouth of Körös ..... /240 rkm/
at Mindszent ..... /216 rkm/
at Tápé, above the mouth of Maros ..... /177 rkm/
below the mouth of Maros ..... /171 rkm/
at the Jugoslav State border ..... /162 rkm/

At the beginning, we have systematically taken water samples at several points between the sampling sites, too. The results of our investigations, however, have convinced us that these were unnecessary. The sites sampled at present systematically are the points of these reaches of Tisza that are characteristic in water-chemical respect. They take place either above or below the mouth reaches of major tributaries /Körös, Maros/ or at a characteristic point of longer reaches free from the mouth of a major river or from a polluting impulse /Mindszent/.

In the initial peroid of investigation, there were samplings on principle in more sampling places, generally twice a year, at other sampling sites at most in every season, i. e. on four occasions a year. This principle has gradually got to the practice applied to-day, and it seems to determine the future practice, as well. At present the water-chemical control of the water-course takes place at fewer sampling sites. At some emphasized, so-called basic sampling cross section however, the frequency of sampling is one a week, i. e. 52 a year. And at the other sampling sites we take at least one sample a month /Figs. 1, 2/.

The Mindszent sample is suitable for characterizing these reaches of the water-course. It contains calcium-magnesium, sometimes calcium, while the dominating anion is hydrocarbonate. There occurs very exceptionally that besides hydrocarbonate also carbonate appears or the sulphate ion becomes dominant. Its dissolved salt content is generally low, having usually a value between 150 and 400 mg/l. We can regard as characteristic a fluctuation of a limited ± 50 mg/l interval in the vicinity of the value 300 mg/l.

The values of its total hardness fluctuate between 5-16 nk^{o}. Aside from the autumn maximum, we may accept in the vicinity of 8 nk^{o} a fluctuation of ± 1,5 nk^{o} as characteristic. Its competent values are, independently from the site and year of sampling, generally above 10 nk^{o}. The percentage of the sodium of the total cation amount /sodium percentage/ is 21 p.c. Even the extreme value of fluctuation does not surpass here ± 10 p.c. Its competent values are generally between 20 to 30 per cent.

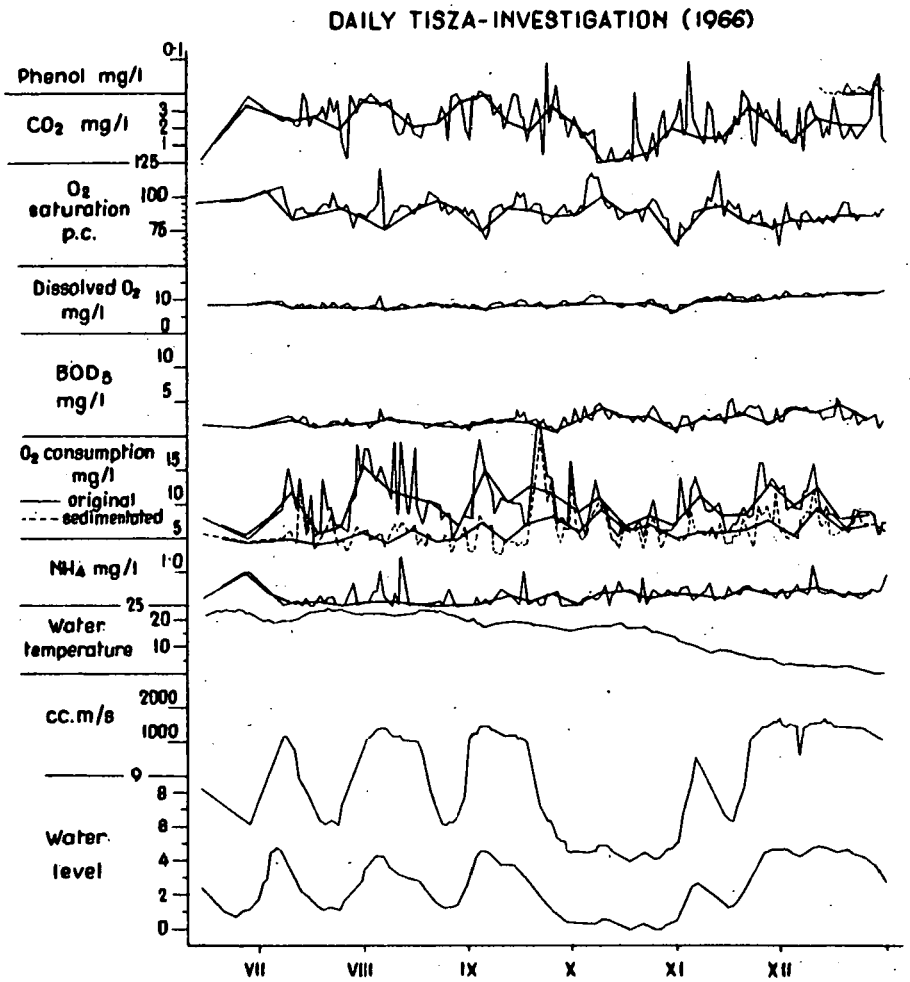

Fig.1. Tisza investigation with daily frequency 1966. /In Szeged/

Black line: Datum series of daily frequency
Red line; datum series of weekly frequency.

Among the anions the amount of chloride ions is mostly changing between 20 and 40 mg/l. In extreme values, there may occur 10 mg/l more or less than that. /Tables 1 and 2/

As to the sodium chloride ion concentration, it is worth while observing that while Körös has not generally any influence on the chemical composition of Tisza, the effect of Maros can periodically be demonstrated. At the sampling sites below the mouth of Maros we may sometimes register changes even in the type of water. From the anions, the occurrence of chloride ions is characteristic; and from the cations some times there increase perceptibly both the absolute value of the sodium amount and similarly the value of its percentage inside the total cation. All that can be attributed to quality and composition of the Maros water, the dissolved salt content of the Maros being generally higher than that of the Tisza, and the sodium and chloride ion concentration being both in absolute value and in percentage higher than the corresponding values of the Tisza. This fact is in connection with the rockbed and its process of decomposition at the upper reaches of the watershed area and the region of the source of Maros. In first approach this can be established about the effect exerted by the Maros on the Tisza.

The sulphate ion concentration of the river water can be characterized by values changing in the vicinity of 35 to 40 mg/l, while the concentration of the hydrocarbonate ion can mostly be measured between the extreme values of 110 to 310 mg/l in the vicinity of the value 200 mg/l.

Before characterizing its oxygen economy, it is worth referring to its suspended matter content. That changes, as depended upon the prevailing conditions of water motion, from values measured with the single order of magnitude through values frequently ten times as high, till the extreme values even several hundred times higher /800 mg/l/. As opposed to the Maros, this is always a characteristically low value, as there at inundations even an order thousand times higher is not rare. And what is generally known, its suspended load is, in contradistinction to the suspended matter of the river Maros, expressedly fine granular sand and silt. While in the Maros it often occurs, because of the concentration of the suspended load, that its biological qualification is hardly or not at all possible, in the Tisza that is only an exceptionally extreme case.

Its dissolved oxygen content is first of all a function of water temperature. In this way, the summer may be 7 mg/l, while the winter maximum even 13. On the other hand, a change observed also as depending on the biological production may be registered first of all together with the changing value of the dissolved oxygen saturation. This never goes below 60 per cent while it can be even as high as 130 per cent. Its standard values can mostly be found

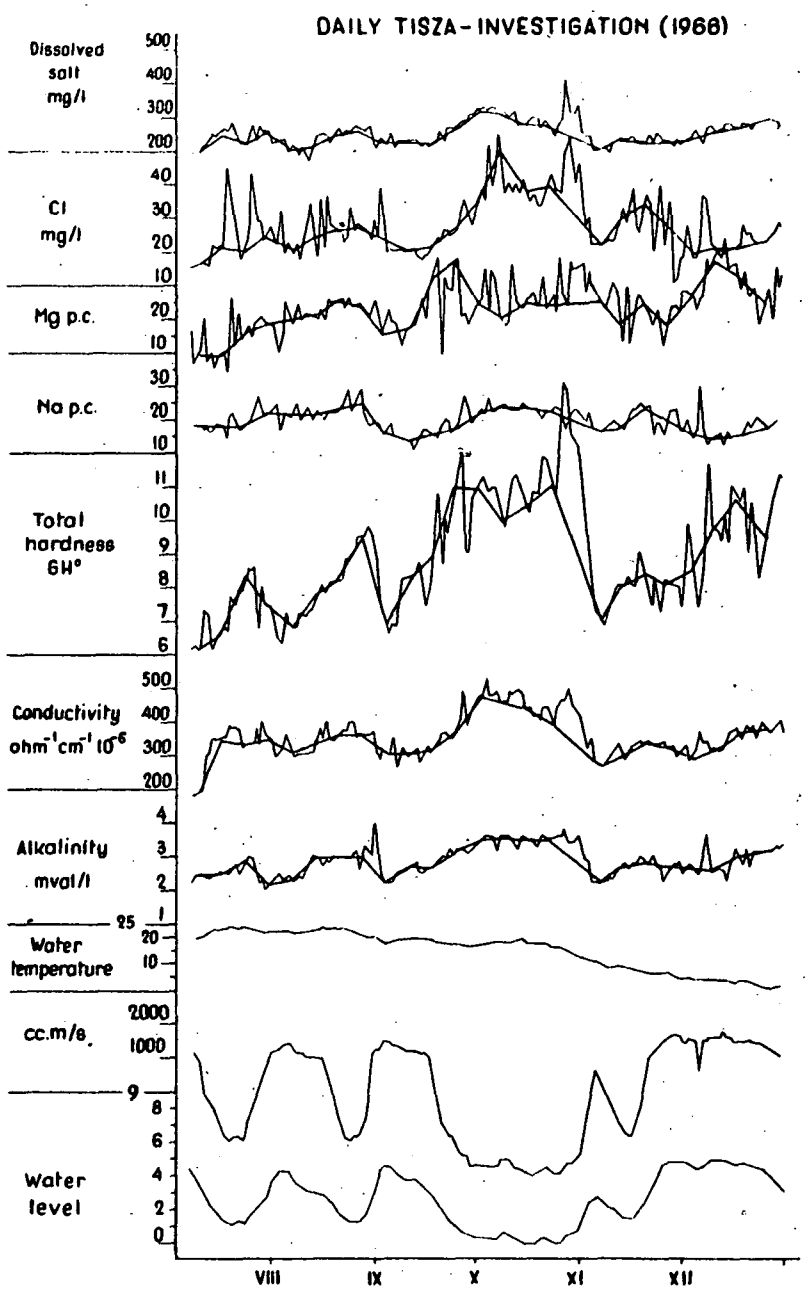

Fig.2. Tisza investigation with daily frequency in 1966 /In Szeged/
Black line; Datum series of daily frequency
Red line; Datum series of weekly frequency.

between 70 and 80 per cent.

The dissolved carbon dioxide content changes between o-5/mg/l, mostly is in the vicissitude of 2 mg/l. It may also be concluded from the datum series of the investigations carried out with a daily frequency that between the decomposition of the polluting impulses touching the river and the values of the consumption and of the dissolved carbon dioxide there may exist a loose correlation.

An interesting change can be registered on the basis of data obtained from the investigations of ten years in the data of the nitrogen uptake. It would be worth while dealing with it separately in more details. Here I should like mentioning only that the values of the ammonia content are mostly below 1 mg/l. We have often measured zero ammonia content or something approaching it. The frequent values are below 0,5 mg/l, while the maximum can be established below 2 mg/l. The nitrite ion concentration is of course low, with a numerical value presented at most in the third place of decimals. But the values of the nitrate concentration in one or two mg/l have markedly increased in the recent years. Increasing gradually in 1967, in December they got to the domain 25 to 30 mg/l. We have not seen, anyway, a similarly high nitrate content but we have found values of tenfold order on several occasions in the latter years. So we found in 1968, similarly in December, a value of 20 mg/l - but not in the sampling site at Szeged in the previous year but in Csongrád - and we have measured nitrate contents of similar value order at other dates, too. In these data we must look for the increase of the intensity of application of manures, chemical fertilizers in agriculture.

A detailed, fundamental investigation of the nitrogen uptake will be the theme of a separate monograph, in the same way, also the investigation of the material traffic of the single ions. The effect of chemical agents, fertilizers applied by the agricultural units in the watershed area, as well as that of the released sewage-water on the traffic in materials, and possibly the mutual effect of the biological processes of water and the traffic of materials; are correlative chapters that can be dealt with in separate papers in their details. At present we cannot treat of them, as yet.

Sulphide ions are never contained in the water of Tisza. They have not been observed, so far even in the vicinity of sewage disposals. Its phenol content is very low. Our programmes have contained the investigation of the anion-active detergent only for a few years. Its values cannot be determined in other waterways of ours, either. They have no importance in the water of the Tisza, as yet, even their maximum being generally far below the value of 1 mg/l. Their minimum is zero or a numerical value presented at most by the second decimal.

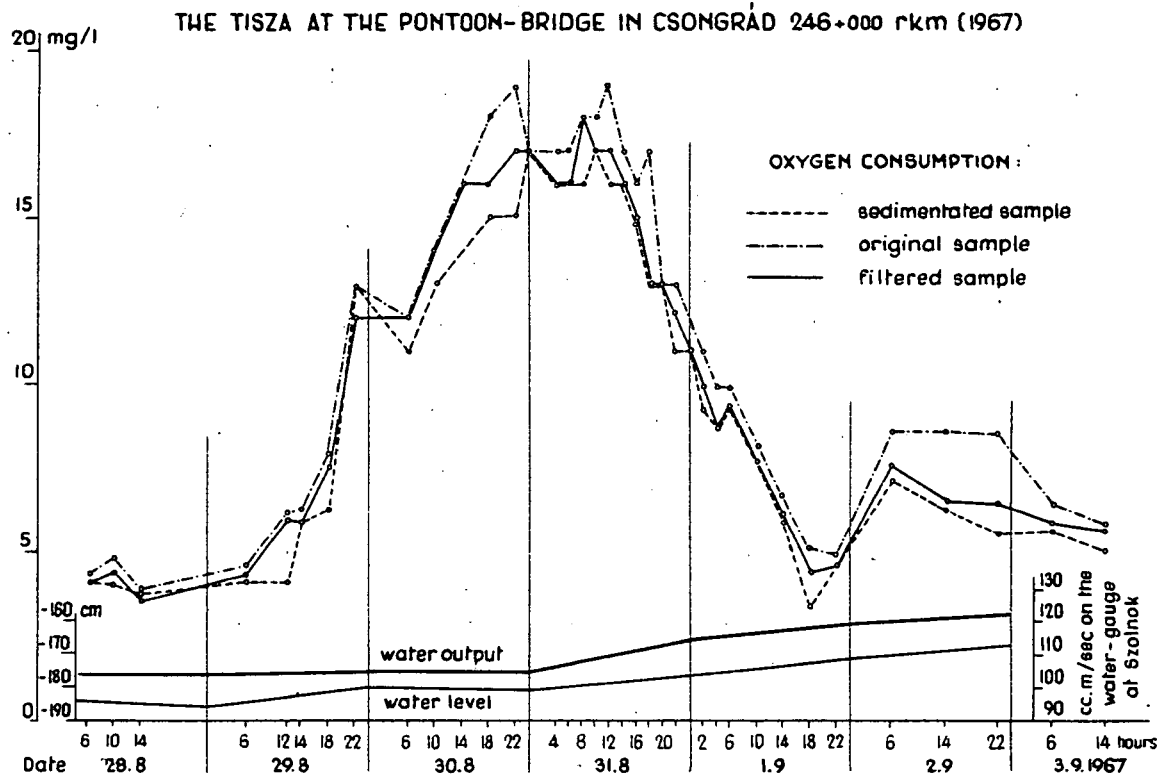

Fig.3. Passing of a sewage wave through the Tisza at Csongrád in 1967. Values of oxygen consumption. /Filtered, original, and sedimentated samples./

The classical indices of being polluted are the oxygen consumption and the biochemical oxygen demand for five days. Their measurement took already place during the first investigations. At the beginning, there have not occurred any extreme values as a result of external polluting influences. In the latter years there were some peculiarly increased values; the most outstanding ones of them were caused between August 29th and September 3rd 1967 in our boundary cross section at Csongrád by the pollution wave arriving there and by the oilpollution connected with it. /Fig.3/ That pollution wave came through the Sajó from the sulphitecellulose factory in Gemerska-Harka and culminated at a 20 mg/l value of oxygen consumption. /In the Sajo pollution wave characterized by an oxygen consuption above 1000 mg/l. The pollution wave described has passed basically unchanged through the reaches of the Tisza held under our control /Fig. 4/. Its maximum values have, of course, lessened in the meantime. The locally interested Authorities of the Water Quality Control have supervised the passing of polluted flood through the whole river under the direktion of the Water Quality Control of the National Office of Water Administration-Centre of the Economy of Water Supplies / P á s z t ó - T h u r n a y 1968/. The paper mentioned is reporting on a damage over eight million Ft in connection with that. The comparison of the two Figures /Nos. 3 and 4/ is interesting because it presents a basis for forming a true general notion of passing in the riverbed of any pollution caused by any foreign organic, non-poisonous matter that got into the river, corresponding to the discussed hydrological conditions.

At the end of summer, in the early autumn, the biological overproduction is not rare. According to the investigations of the biologist Mrs. L. D o b l e r - and also according to the data published in the literature by G. U h e r k o v i c h /1966, 1968, 1969/ - there increased that overproduction on those occasions on an unusually large scale. The ephemera /called "efflorescence" of the Tisza/ could be observed by a naked eye,too. Apart from dominate *Melosira* and *Cyclotella* species, she carried out the identification of thirty species. It was surprising that in the period of culmination *Aphanisomenon flos-aquae* became dominant in an almost unparalleled extent. It dominated the living space about in 80 p.c. And the intensity of the "efflorescence" became stronger going down the river in the Csongrád-Szeged reaches.

After outlining this definitely interesting phenomenon, we return to the classical indices of the water pollution establishing that the oxygen consumption in these reaches of the Tisza falls mostly between the values 3 to 10 mg/l. The biochemical oxygen demand is always lower than that, remaining generally below 5 mg/l, while a value of the oxygen consumption lower than 3 mg/l nearly never occurs, and a higher value than 10 mg/l is to be observed only rarely but more and more frequently. We have measured some years ago even values above 15 mg/l, as well.

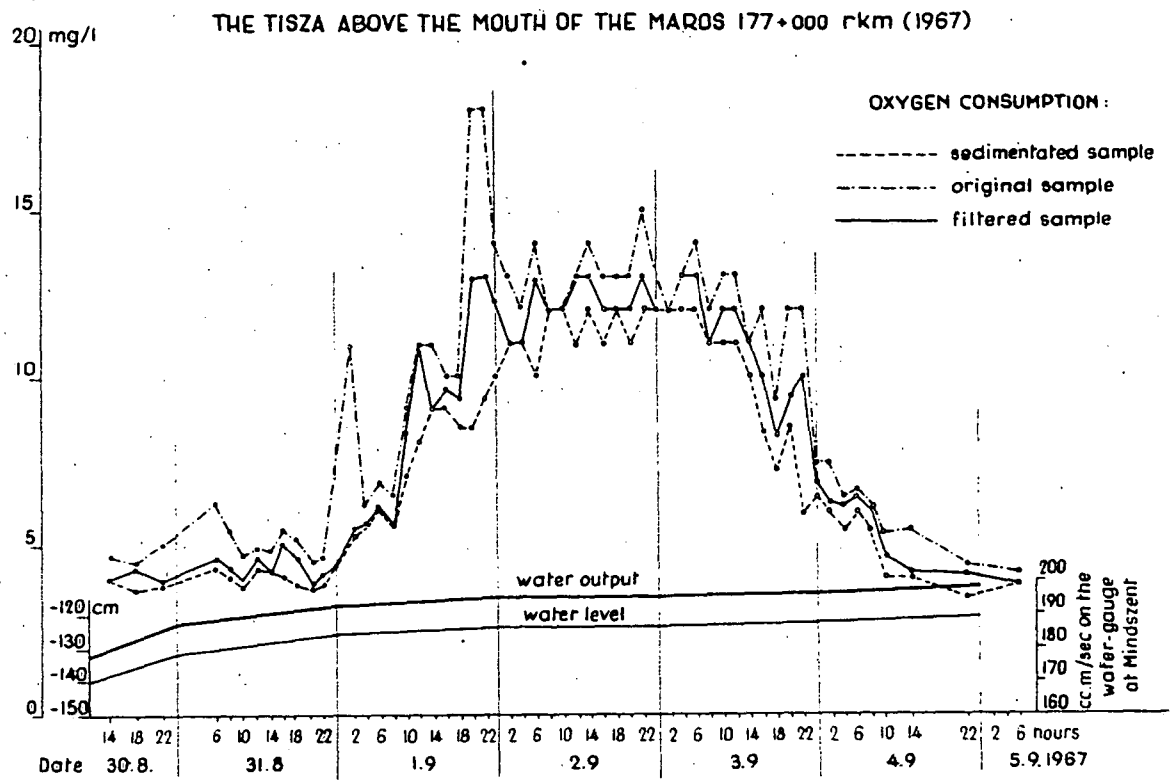

Fig.4. Passing of a sewage wave through the Tisza above the mouth of Maros in 1967.
Values of oxygen composition /Filtered, original, and sedimentated samples/..

It is characteristic of the water content of the river being inclined to extremes that the values of water level fluctuate about 8 m on the average, while the extreme values may be even as high as 11 metres here and there. The extreme distribution of precipitation, the changeable alternation of humid and arid years do increase the degree of fluctuation. This speaks for our suggestion, too, that for registering the water quality of the river, for mapping its alternations we have to increase the frequency of samplings. The quality of water that depends upon the water motion, resp. output can namely not be defined exactly without that / G o d a 1965/.

The same demand is supported also by the fact that the Tisza carries on the average 25,4 thousand million cubic m water into the Danube a year. It may be felt even at a static outlook that it is reasonable to encrease the amount of the representative water samples, collected on the basis of the practice until now, for being able to characterize more perfectly a large amount of water like that. Not to speak about that, also the security of the calculation of correlation for investigating the connection between the quality of water and any other hydrological characteristics is increased in high degree by the more data got by the more frequent sampling inside the same cross section. Similarly to the connections, found by T. D v i h a l l y, Zs. - V á g á s I. /1966/ in the Danube between the water output and flood wave and the water-chemical conditions, we can create a more secure basis also for the practical life by mapping more continuously the water-chemical conditions. It seems, therefore, to be necessary in the future to increase the frequency of samplings in any sampling site. There arises the question of telemetering, automatization, and even a continuous application of these concerning certain components. We can obtain an immense number of data in that way. And that is very good and useful. At any rate, in spite of that we can get a really clear picture about a water course only with a method like this, we must needs be satisfied with our situation inside the framework of the possibility available for us. The practical life is namely unable so far to elaborate the mass of data obtained by automatic, continuous registering. I should like, anyway, to turn the scale in this question from the situation of equilibrium in favour of accumulating the measurement data. In the following years the mechanized elaboration of data will be capable of arranging the datum series of long years and drawing the possible conclusions. The non-measured data, the informations that have not been collected in the present, will not be able to be reproduced in the future even by the most perfect system of datum elaboration.

Summary

The laboratory of the Water Quality Control in the Water Management of the Lower Tisza Region has carried out water quality investigations in

the reaches between Csongrád and Szeged of the Tisza for ten years.

These reaches of the river are represented with a good approach by the quality composition at river km No. 216 in Mindszent, from the sampling places enumerated.

In the amount of components, in the change of the classical indices of water pollution some tendency may be recognized /nitrate, oxygen consumption/. The character of water is determined by the low dissolved salt content and changing suspended load of the water of low, resp. middle hardness, with a basic content of calcium-magnesium, sometimes of calcium, hydrocarbonate.

An increase of the frequency of samplings took already place in the course of the practice so far, perfecting highly already to-day the picture made about the change of water quality of the river. A further increase of that partly may illuminate the extreme values of the single components, partly may ensure a more secure basis for the calculations of correlation between the water-chemical and hydrological and also other data.

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Table 1

Result of a water sample investigation

No.	Denomination	mg/l	mgrw/l
1.	Site of sampling; the Tisza at Mindszent.		
2.	Date of sampling; July 21st 1969. 2 p.m.		
3.	Place of the water-gauge; Mindszent, 216 + 200 rkm		
4.	Water level on the water-gauge; 278 cm.		
5.	Water output at the water-gauge; 655 cc.m/sec.		
6.	Character of the change of water level; going down		
7.	Endurance percentage of water level; 27.2		
8.	Frequency of water output in days; 3.1		
9.	Air temperature; 18 C^{o}		
10.	Water temperature; 20^{o} C		
11.	Colour; yellowish brown		
12.	Smell; odourless		
13.	Transparency; 15 cm		
14.	Oxygen consumption	5.0	
15.	Biochemical oxygen demand /for 5 days/	4.6	
16.	Dissolved oxygen;	6.8	
17.	Oxygen saturation; 75 p.c.		
18.	pH; 7.3		
19.	Conductivity; 328 ohm $^{-1}cm^{-1}10^{-6}$		
20.	Methylorange alkalinity; 2.60 mval/l		
21.	Total hardness; 8.18 GH^{o}		
22.	Carbonate hardness; 7.28 GH^{o}		
23.	Calcium	45.0	2.25

No.	Denomination	mg/l	mgrw/l
24.	Magnesium	8.3	0.68
25.	Sodium	23.0	1.00
26.	Potassium	4.3	0.11
27.	Total cation equivalent		4.04
28.	Chloride	25.0	0.70
29.	Sulphate	38.4	0.80
30.	Hydrocarbonate	158	2.60
31.	Carbonate	0	0
32.	Total anion equivalent		4.10
33.	Free carbon dioxide	1.84	-
34.	Iron	0.05	-
35.	Manganese	0	-
36.	Ammonium ion	0.45	-
37.	Nitrite	0.036	-
38.	Nitrate	2,5	-
39.	Phosphate	0	-
40.	Sulphide	0	-
41.	Silicium dioxide	11.4	-
42.	Total dissolved matter	233	
43.	Total suspended load	478	
44.	Total dry matter	711	
45.	Oil	0	
46.	Phenols	0.013	
47.	Anion-active detergent	0	
48.	Sodium percentage; 24.8 p.c.		
49.	Magnesium percentage; 23,2 p.c.		
50.	Hydrocarbonate percentage; 63 p.c.		
51.	Sulphate percentage; 20 p.c.		
52.	Chloride percentage; 17 p.c.		
53.	Water type; of calcium - hydrocarbonate		
54.	Biological state; a-b meso-saprobe		
55.	Saprobity index; S = 2.20		

Table 2

Evaluation of water samples taken at Mindszent
1969.

/On the basis the OVF Instruction entitled; "COMECON Unitary Water Quality Norms and Principle of Their Qualification" and "Water Quality Investigations and Their Evaluation"/.

/Number of evaluated water samples; 39/

No.	Component;	Values				Water outputs belonging to the measured values	
		Unit of measurement	minimum	maximum	Standard	minimum	maximum
1.	Oxygen consumption	mg/l	3.1	8.0	5.9	372	1600
2.	Dissolved oxygen saturation	p.c.	59	98	70	291	220
3.	pH	-	7.15	7.90	7.75	1600	413
4.	Total hardness	GH^0	6.36	12.78	11.93	1224	200
5.	Ammonia	mg/l	0.10	4.00	1.59	220	285
6.	Sulphide	mg/l	0.0	0.0	0.0	168	1600
7.	Total dissolved matter	mg/l	187	363	343	511	168
8.	Total suspended load	mg/l	3	706	425	301	908
9.	Oil	mg/l	0.0	0.0	0.0	168	1600
10.	Phenols	mg/l	0.0	0.64	0.03	430	413
11.	Detergents	mg/l	0.0	0.80	0.23	381	498
12.	Sodium	p.c.	11.2	32.4	27.9	511	503
13.	Oxygen consumption with measuring solution $K_2Cr_2O_7$	mg/l	5.2	40	33	648	655

TISCIA /SZEGED/ 6, 1970-71

Über das Phytoseston der eutrophierten Theiss /Tisza/ II. Zur Frage der Indikatoralgen für den eutrophierten Flusszustand

G. UHERKOVICH

Damjanich Museum, Laboratorium für Tisza-Forschung, Szolnok
/Eingegangen am 15 Februar 1970/

Einleitung

Das Problem, wie weit die Gewässer mit Nährstoffen für die pflanzlichen Organismen versehen sind, also das Trophitätsproblem und innerhalb diesem die Frage der Eutrophie, wurde bisher in der limnologischen Literatur vornehmlich in Bezug auf die Stillgewässer /Seen, Teiche, vorübergehende Stillgewässer/ erörtert /D u s s a r t 1966, F o t t 1959, O h l e 1955, R u t t n e r 1952, S e b e s t y é n 1963, T h i e n e m a n n 1925, 1955/. Es war zwar durch manche Veröffentlichungen /z.B. R a g o t z k i e - P o m e r o y 1957, C l a u s 1961, U h e r k o v i c h 1968 a, b, 1969 a, b/ bereits bekannt, dass es auch in Flüssen zu Algenmassenvermehrungen kommen kann und dass dieser Umstand unter gewissen Voraussetzungen auf einen eutrophierten Zustand des untersuchten Flusses hindeutet, doch wurden diese Einzelbeobachtungen bisher nicht verallgemeinert.

Die Begriffe des oligotrophen, eutrophen und dystrophen Seetypus /Gewässertypus/ sind in der Limnologie seit längerem eingebürgert. Die Abgrenzung dieser Typen voneinander war anfänglich ziemlich steif und von statischem Inhalte. Doch hat bereits J ä r n e f e l t /1952, 1956/, der mehrere hundert Seen Finnlands mit der zuverlässlichen quantitativen Methode von U t e r m ö h l untersuchte, die Tatsache betont, dass auch ein und derselbe See im Laufe der Jahren und sogar im Verlaufe eines einzigen Sommers versichiedene "Typen des Planktons" aufweisen kann, somit ist eine Aufstellung von steifen Kategorien über die "Trophietypen" nicht stichhaltig.

Ein jedes Gewässer kann zu verschiedenen Zeitpunkten einen ausgeprägteren oder grade nur angedeuteten eutrophierten Zustand, bzw. einen deutlicher oder nur verschwommen hervortretenden Zustand der Oligotrophie aufweisen, und den Charakter des Seetypus /Gewässertypus/ bestimmt dann "der Gesamtablauf des Stoffkreislaufes im See während der ganzen natürlichen Vegetationsperiode, d.h. im allgemeinen während des Jahres" /T h i e n e m a n n 1955/.

Aus praktischen Gründen scheint es angebracht zu sein, wenn wir zwischen dem aktuellen Trophiezustand und dem Trophietyp eines Gewässers unterscheiden, z.B. zwischen dem aktuellen Grade der Eutropie /Eutrophierung/ eines Gewässers und dem Typ, welchen - nach dem Gesamtbild des Stoffkreislaufes beurteilt - ein eutrophes Gewässer aufweisen kann. Der aktuelle Grad des Eutrophie -, oder überhaupt des Trophiezustandes kann offenbar leichter

ermittelt werden, als der Typ, dessen Feststellung Untersuchungen über den Gesamtstoffkreislauf voraussetzt.

Indikation des Trophiegrades durch Mikrophyten

Man nimmt an, dass der Trophiezustand eines Gewässers durch die Anwesenheit gewisser Indikatororganismen bezeichnet oder wenigstens angedeutet wird. So meint z.B. J ä r n e f e l t /1952/, dass *Microcystis viridis* /A.BR./ LEMM. *Lepocinclis fusiformis* / C a r t e r / L e m m., *Planctomyces bekefii* G i m e s i für die Eutrophie charakteristisch sind. F o t t /1959/ nimmt einen Indikatorwert folgender Organismen für eutrophe Seen an: *Cyclotella meneghiniana* K ü t z., *Stephanodiscus hantzschii* G r u n ., *Stephanodiscus dubius* F r i c k e, *Attheya zachariasii* J. B r u n, *Synedra acus* var. *angustissima* G r u n., *Microcystis viridis* /A.BR./ L e m m., *Aphanizomenon gracile* L e m m., *Chroococcus dispersus* /K e i s s l e r/ L e m m., *Peridinium palatinum* L ü t k e m., *Kirchneriella lunaris* /K i r c h n./ M o e b., *Pediastrum duplex* M e y e n, *Staurastrum tetracerum* R a l f s, *Closterium acerosum* /S c h r a n k/ Ehrbg. und noch weitere Arten /F o t t 1959/.

Aber nicht bloss der Fund gewisser Indikatororganismen orientiert uns über den Trophiezustand, Trophiecharakter und letzten Endes über den Trophietyp eines Gewässers, sondern vielleicht noch mehr das gegenseitige Verhältnis der im Phytoseston /Phytoplankton/ vertretenen Algengruppen. Dieses Verhältnis nennt man nach T h u n m a r k /1945/, dem Begründer dieser Theorie, den "Planktonquotient" vgl. auch N y g a a r d 1949/. T h u n m a r k hat angenommen, dass das Verhältnis der planktischen *Chlorococcalen* zur Gruppe der *Desmidiales* einen charakteristischen Wert für den Seetypus darstellt. Wenn die Zahl der *Desmidiales*-Arten überwiegt, so sei das betreffende Gewässer von oligotrophem Typ und umgekehrt. $Q = \frac{Ch}{D}$ 1 = eutroph = oligotroph.

Die Behauptungen von T h u n m a r k scheinen mir - wenigstens für die nordeuropäischen Stillgewässer - gut begründet und stichhaltig zu sein. /Es bleibt allerdings fraglich - und man sollte dies durch spezielle Untersuchengen klären - ob der "Planktonquotient" von T h u n m a r k auch für die Gewässer anderer Klimaten zustimmt/. Der Kern von diesem Gedanken, dass nämlich nicht bloss die Anwesenheit einzelner Indikatororganismen, sondern auch die Hauptzüge der Zönose Stützpunkte für die Beurteilung des Trophiegrades geben können, ist meines Erachtens von allgemeiner Gültigkeit und sollte für Forschungen auf dem Gebiete der Trophieprobleme sehr anregend auswirken.

Sowohl die Frage der Indikatororganismen als auch die der zönologischen Indikatorquotienten sind nach meiner Ansicht vor allem durch mathematische-statistische Methoden zu lösen. Man müsste zahlreiche Zönosen von untereinander vergleichbaren Gewässern, die mit einer einwandfreien quantitativen analysiert wurden, statistisch vergleichen. Erst an Hand einer grösseren Fülle solcher Ergebnisse ist man dann berechtigt zu gewisse Verallgemeinerungen vorzuschreiten.

Indikatoralgen für den eutrophierten Zustand von Fliessgewässern

Wenn wir über die quantitative Zusammensetzung des Phytosestons verschiedener Flüsse umfangreiche Angaben im Vorrat hätten, so wäre es bereits jetzt möglich, die Flüsse in einem "Trophiesystem" einzuordnen. Zur Lösung des Trophieproblems von Fliessgewässern wurden aber bisher nur wenige Untersuchungen ausgeführt. Eben deswegen können über dieses Problem die in Betracht kommenden zusammenfassenden Werke /B l u m 1956, L u n d 1965 usw./ nur wenig aussagen. Trotz der spärlichen Angaben lässt es sich doch feststellen, dass man von Flüssen mit durchschnittlich reicherem Phytoseston und von solchen mit durchschnittlich individuenärmeren Phytoseston sprechen kann, und ferner, dass auch in den Flüssen ein aktueller eutrophierter Zustand entstehen kann. Letzterer lässt sich durch eine auffallend erhöhte Phytosestonproduktion, durch ein individuen- und artenreiches Phytoseston erkennen. /Das Artenreichtum des Phytosestons, die erhöhten Individuenzahlen von mehreren Arten sind hier unbedingt zu betonen, da die auffallende Vermehrung eines einzigen Organismus eher als die Verschiebung der Saprobitätszustände zu deuten ist./

In der Theiss /Tisza/ und in anderen ostmitteleuropäischen Flüssen habe ich wiederholt solche individuen- und artenreiche Phytosestongemeinschaften beobachtet, die offenbar mit aktuellen eutrophierten Zuständen der betreffenden Flüsse verknüpft waren. Meine diesbezüglichen quantitativen Phytosestonstudien gaben mir Gelegenheit, gewisse Aspekte der Frage der Indikatoralgen für den eutrophierten Flusszustand in Augenschein zu nehmen. Gewisse gemeinsame Züge solcher Phytosestongemeinsshaften liefern für eine zukünftige Verallgemeinerung wertvolles Tatsachenmaterial.

Unter den von mir untersuchten zahlreichen Phytosestongemeinschaften habe ich zu einer vergleichenden Analyse 16 Fälle ausgewählt. Davon stammten 8 aus der Theiss, 3 aus dem östlichen Hauptkanal /gehört zum Wassersystem der Theiss/, 1 aus dem Flusse Laborc oder Laborec /ein Nebenfluss der Theiss/ 2 aus der Donau bei Baja und 2 aus der Weichsel /Wisla oder Vistula/. Die Gesamtindividuenwerte dieser Phytosestongemeinschaften bewegten sich zwischen Σ Ind./ℓ. 500000 und 26000000. Bei der vergleichenden Analyse dieser Zönose /s.die Tabelle I/ habe ich jene Mikrophytenorganismen herausgehoben, die in der quantitativen Zusammensetzung der verglichenen Bestände mit bedeutenden Individuenzahlen vetreten waren. Es waren deren 19, undzwar 9 Kieselalgen-Arten, 9 *Chlorococcalen-Arten* und eine Wasserpilzart. Es wurden bei diesen Mikrophyten die durchschnittlichen Ind./ℓ-Werte und %-Werte errechnet, ferner die Häufigkeitskoefizienten aus den 1-16. Proben.

Es hat sich herausgestellt, dass in den verglichenen 16 Fällen die *Cyclotella*-Arten die höchsten durchschnittlichen Werte erreichten = 2754250 Ind./ℓ, bzw. 41 %, und 16/16:1. Unter den Kieselalgen waren noch folgende Organismen von ausschlaggebender Bedeutung für die quantitative Zusammensetzung der verglichenen Zönosen = *Melosira granulata* var. *angustissima* /221470 Ind./ℓ, 8,12 % , 16/16:1/, *Nitzschia acicularis* /222940 Ind./ℓ. 8,37 %, 16/16:1/, *Stephanodiscus dubius* /91100 Ind./ℓ. 1,48 %, 16/16:1/.

Einige weitere Kieselalgen-Arten sind in dieser Hinsicht ebenfalls von Bedeutung = *Nitzschia palea* /73000 Ind./ℓ. 1,08 %, 16/16:1/ *Synedra /Nitzschia/ actinastroides* /211700 Ind./ℓ. 6,96 %, 13/16:0,81/, *Attheya zahcariasii* /83000 Ind./ℓ. 3,86 %, 8/16:0,50/, *Melosira granulata* /33000 Ind./ℓ, 0,86 %, 9/16:0,56/, *Synedra acus* /52700 Ind./ℓ, 1,95 %, 14/16:0,88/.

Unter den *Chlorococcalen* waren allein die Arten *Ankistrodesmus angustus* /273280 Ind./ℓ. 4,95 %/, *Scenedesmus acuminatus* /37470 Ind./ℓ. 1,18 %/ und *Scenedesmus opoliensis* /49850 Ind./ℓ, 1,19 %/ in sämtlichen untersuchten Zönosen anwesend /16/16:1/. Die Arten *Actinastrum hantzschii* /60950 Ind. /ℓ. 1,16 %, 14/16:0,88/ und *Scenedesmus granulatus* /57900 Ind./ℓ. 0,95 %, 13/16:0,81/ waren in den untersuchten Zönosen ebenfalls häufig. Einige weitere - mit grossen Individuenzahlen vertretene - Arten waren dagegen schon weniger häufig = *Dictyosphaerium pulchellum* /129300 Ind./ℓ. 2,96 %, 11/16:0,69/, *Didymocystis tuberculata* /131000 Ind./ℓ. 2,82 %, 5/16:0,31/, *Scenedesmus ecornis* /56750 Ind./ℓ. 0,38 %, 11/16:0,69/.

Unter den übringen planktonischen Mikrophyten war die Wasserpilzart *Planctomyces bekefii* /266000 Ind./ℓ. 2,79 %/ in sämtlichen untersuchten Zönosen und mit bedeutenden Individuenzahlen vertreten.

Zu den aufgezählten Daten möchten wir noch einiges hinfügen. Die Kieselalge *Attheya zachariasii* ist für die eutrophierten Gewässer gewiss von grösserem Indikationswert, als dies aus meinen Angaben hervorgeht /vgl. F o t t 1959/, doch grade in den Flüssen wird dieser Organismus mit sehr dünnen und zerbrechlichen Zellumhüllung durch die Turbulenz stark geschädigt, in seiner Entwicklung limitiert. So ist in den Flüssen mit einer grösseren Vermehrung dieser Alge nur zur Zeit der tiefsten Wasserstände, also in den Perioden herabgesetzter Turbulenz zu rechen. Die erhöhte Turbulenz - wie man das mit Gewissheit annehmen kann - ist auch bei den Algen *Synedra acus*, *Synedra /Nitzschia/ actinastroides* und *Actinastrum hantzschii* von limitierender Auswirkung.

Zwei weitere Bemerkungen: Die sehr kleinen und nicht immer leicht identifizierbaren *Didymocystis*-Arten - insbesondere die Art *D. tuberculata* - sind meiner Auffassung nach weit verbreiteter in den eutrophierten Gewässern, wie das aus den bisherigen Publikationen hervorgeht. Bei der Art *Nitzschia palea* ist es zu bemerken, dass diese Alge besonders in solchen Gewässern massenhaft auftritt, welche in der vorausgehenden Zeit von starker organischer Verschmutzung belastet wurden und zur Zeit der Probeentnahme sich in Stadium der intensiveren Selbstreinigung befinden. Mittelmässige Individuenzahlen - und in den untersuchten Fällen handelte es sich um solche - dieser Alge sind höchstwahrscheinlich Begleiterscheinungen des eutrophierten Flusszustandes. /Dies steht keineswegs im Widerspruch mit dem vorher Erwähnten./

Zusammenfassende Betrachtungen

Die bei unseren Erörterungen in Betracht gezogenen Flüsse haben mehrere gemeinsame Züge: sie gehören u. a. zum gleichen grösseren Klimagebiet, ihre Fliessgeschwindigkeit, ihre Mengen an Schwebestoffen sind annähernd gleich gross. Jene Verallgemeinerungen, zu denen wir aus den Tatsachen über diese Flüsse gelangen, können mit guter Annäherung im allgemeinen für die ostmitteleuropäischen grösseren Flüsse als gültig betrachtet werden.

Nach meinen Angaben ist es anzunehmen, dass im ostmitteleleuropäischen Raum auf den aktuellen eutrophierten Zustand grösserer Flüsse die grösseren Individuenzahlen folgender Mikrophyten hindeutet = *Cyclotella-Arten, Nitzschia acicularis, Melosira granulata* var.*angustissima, Stephanodiscus dubius, Nitzschia palea, Ankistrodesmus angustus, Scenedesmus opoliensis, Scenedesmus acuminatus, Planctomyces bekefii.* Bei diesen Organismen ist also ein Indikationswert für den eutrophierten Flusszustand anzunehmen. Bei folgenden Algen ist dieser Indikationswert in mehr-weniger beschränktem Masse auch anzunehmen = *Melosira granulata, Dictyosphaerium pulchellum, Didymocystis tuberculata, Scenedesmus granulatus, Scenedesmus ecornis.* Bei machen Algen wird die volle Entfaltung eines Indikationswertes in den Flusszönosen grade durch die speziellen limitierenden Umstände des Fliessgewässers eingeschränkt. Zu dieser Kategorie gehören = *Attheya zachariasii, Synedra /Nitzschia/ actinastroides, Synedra acus, Actinastrum hantzschii.*

Diese Erörterung ist bloss als ein Beitrag zu einer umfassenderen Verallgemeinerung zu betrachten. Angaben, die auf ähnlicher breiter statistischer Basis ruhen, werden eine solche umfassendere Verallgemeinerung wahrscheinlich erleichtern.

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Verbreitung der Arten Plantago Schwarzenbergiana Schur., Vicia biennis L. und Astragalus contortuplicatus L. in der Vojvodina

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Die Arten, über deren Verbreitung hier in dieser Arbeit Angaben vorgetragen werden, stellen drei sehr typische pontisch-pannonische Pflanzenarten dar. Alle drei finden sich in der Vojvodina im südwestlichen Grenzgebiet dieses Areals. Aus diesem Grunde ist es von besonderem Interesse, deren Verbreitung bei uns zu untersuchen.

Die in dieser Arbeit hierüber vorgetragenen Angaben stammen zum Teil aus eigenen Beobachtungen auf dem Gelände, teilweise aus der Fachliteratur und aus herbarischen Sammlungen.

Die genaue Feststellung ihrer Verbreitung bei uns kann als Grundlage zur Lösung gewisser pflanzengeographischer Probleme von allgemeiner Wichtigkeit im Zusammenhang mit diesen Arten dienen. Für unser Land ist das Problem eher von lokal beschränkter Bedeutung, doch sind die Daten wertvoll zur Gewinnung einer genauen Einsicht in die pflanzengeographische gegenseitige Abgrenzung der Gebiete, zu welchem der pannonische Teil unseres Landes gehört.

Gemäss den angeführten Quellen stellt sich die Verbreitung der fraglichen drei Arten bei uns in der Vojvodina folgenderweise dar:

Plantago schwarzenbergiana S c h u r .

Hinsichtlich des Areals ist dies ein karpatisch-pannonisches Element, vermutlich östlicher Herkunft, nachdem die systematischen Beziehungen zur Art *Plantago sibirica* ziemlich eng sind.

In der Pannonischen Ebene verläuft die westliche Grenze des Gebietes des häuptsachlichen Vorkommens dieser Art vorwiegend entlang der Theiss. Es muss sogleich darauf hingewiesen werden, dass dies eine ausgeprägte Art von halophyten Solonezbodenpflanze ist, welche zusammen mit *Statice gmelini, Artemisia monogyna, Puccinelia limosa, Lepidium cartilagineum* u. s. w. vorkommt, so dass auf deren Verbreitung ausser den klimatischen Einflüssen auch der Bodentyp von Bedeutung ist, was eine spezifische Eigenschaft deren Areals darstellt.

Bei uns wird das Vorkommen der *Plantago Schwarzenbergiana* zum ersten Mal in der Umgebung von Stari Bečej und Srbobran angeführt /Jávorka 1925/. Es wird erst später, in den Arbeiten von S l a v n i ć, eine Anzahl weiterer Vorkommensorte dieser Art im Banat und in der Bačka festgestellt, wodurch eine klarere Übersicht über die Verbreitung dieser Pflanze in der Vojvodina gewonnen wird

/ S l a v n i ć 1943, 1948, 1950 /.

Laut Angaben aus diesen Arbeiten wäre die Liste der Orte des Vorkommens der *Plantago Schwarzenbergiana* in der Vojvodina die folgende:

in der Bačka	im Banat
Stari Bečej, Srbobran, Senta,	Ostojićevo, Sajan, Bočar, Kumane
Martonoš, Horgoš,	Beodra, Melenci, Elemir, Vatin

Hieraus ist ersichtlich, dass die westliche Grenzlinie des Areals dieser Pflanzenart bei uns im Theissgebiet liegt, bis zu Bečej.

Diese Angaben sind in drei Hinsichten bedeutsam, nämlich mit Bezug auf folgende Tatsachen. Gemäss der obigen Liste der Vorkommensorte ist die Art bei uns zonal Beschränkt verbreitet und wurde bisher ausserhalb der Grenzen des Areals, woselbst die Art an allen geeigneten Lokalitäten in Erscheinung tritt /wo immer der entsprechende Solonezboden vorhanden ist/ keine einzige Exclave gefunden.

Es steht also als Tatsache fest, dass die Grenzen des Areals dieser Pflanzen bei uns in westlicher und südlicher Richtung scharf gezogen sind und dass die Verbreitung der Art an diesen Grenzen jäh aufhört.

Eine solche Einschränkung auf ein scharf umgrenztes Areal lässt sich nur zum Teil durch spezifische aedaphische Bedingungen erklären. Dass der wichtigste Faktor in der Bestimmung der Arealgrenzen das Klima ist und nicht der Bodentyp, ist aus der Tatsache ersichtlich, dass in der Vegetation auf Solonezböden in der Donauebene diese Pflanze nicht vorkommt, obwohl diese Gebiete des Westens der Bačka zumindest geographisch, verhältnismässing nahe liegen zum Vorkommensgebiet der *Plantago Schwarzenbergiana*. Zu Gunsten der Annahme, dass die klimatischen Verhältnisse als entscheidende Faktoren anzusehen sind, welche die Grenzen der Verbreitung dieser Pflanze nach dem Westen und dem Süden hin bestimmen, spricht auch der Umstand, dass die Grenzen des Areals mit den entsprechenden Isothermen übereinstimmen.

Auf diesen Umstand wies S l a v n i ć hin, als er hervorhob, dass die Vorkommensorte dieser Pflanze unter der Isotherme für Januar von - 2°C, unter der Isotherme für April von 12°C und für Juli von 23°C begrenzt liegen. Nur die Oktober-Isotherme von 12°C schliesst, hier in der Vojvodina, das Areal dieser Art in sich ein.

Hierzu kommt, dass die *Plantago Schwarzenbergiana* dort vorkommt, wo die Niederschlagsmengen die allerniedrigsten sind. Der Jahresdurchschnitt der atmosphärischen Niederschläge im Vorkommenarea der Art bewegt sich zwischen 500 und 600 mm /in einzelnen Jahren auch weniger als 400 mm/ wovon auf die Vegetationsperiode 200 bis 300 mm entfallen. Alle diese Daten deuten klar darauf hin, dass das Vorkommensgebiet der *Plantago Schwarzenbergiana* an jene Gegend der Vojvodina beschränkt ist, welche die niedrigsten Temperaturen und geringsten Niederschlagsmengen haben.

Gewisse phytozönologische Analysen beweisen, dass auch andere Pflanzen aus der Vegetation der Solonezböden zusammen mit der *Plantago Schwarzenbergiana* stenotope Arten sind, die in einem hohen Prozentsatz /um die 70 % herum/ zu den kontinentalen, pontischen und pontisch-mediterranischen floristischem Element gehören. Dies wiederum deutet klar die Standortsbedingungen an, welche in den betreffenden Gebieten bestehen. /S l a v n i ć 1950/.

Es ist von besonderem Interesse für die bei uns bestehenden pflanzengeographischen Verhältnisse den Umstand hervorzuheben, dass unser Theissgebiet zu einem Teil dem Gebiet Crisicum, teilweise aber zum Gebiet T i t e l i c u m gehört. Wo die genaue Grenzlinie zwischen diesen beiden pflanzengeographischen Gebieten verläuft, konnte bis jetzt noch nicht geklärt werden. Dass die Abgrenzung irgendwo in der Höhe von Bečej vorausgesetzt werden sollte, folgt aus der Tatsache, dass die obere Grenze des Vorkommens von *Plantago Schwarzenbergiana* ungefähr in der Nähe dieser Stadt verlauft. Aus den nachfolgenden Ausführungen werden wir auch ersehen, dass sich dies auch hinsichtlich der Verbreitung der *Vicia biennis* ebenso feststellen lässt.

Vicia biennis L. /*V.picta* F i s c h. et M e y./

Dies ist eine pontische Pflanze, verbreitet in Sibirien, Südrussland, Rumänien und Ungarn, sowie bei uns in der Theissgegend /J á v o r k a 1925/.

Auf unserem Gebiet sind nur drei Vorkommensorte verzeichnet, wo diese östliche Pflanze gefunden wurde, wodurch aber deren Bedeutung für die Flora der Vojvodina nicht vermindert wird. In der Arbeit von K o v á c s finden wir umfassende Daten über die Verbreitung von *Vicia biennis* in der Umgebung von Stari Bečej, wo er diese Art zum ersten Mal im 1914 Jahr aufgefunden hatte. In derselben Arbeit wird auch ein anderer Fundort dieser interessanten Pflanze angeführt /bisher der einzige im Banat/ in der Nähe von Beodra, wo es seitens T h a i s z angeführt wird. Es wurde auch darauf hingewiesen, dass die Art möglichst nahe an die Theiss, in feuchten Niederungen, oft zusammen mit den Pflanzen *Picris echioides* und *Galega officinalis* vorkommt /K o v á c s 1929/. Der dritte Standort wurde neuerlich festgestellt, und dieser befindet sich bei Kanjiža, ebenfalls in der unmittelbaren Nähe der Theiss, im nördlichen Teil der Bačka /O b r a d o v i ć/.

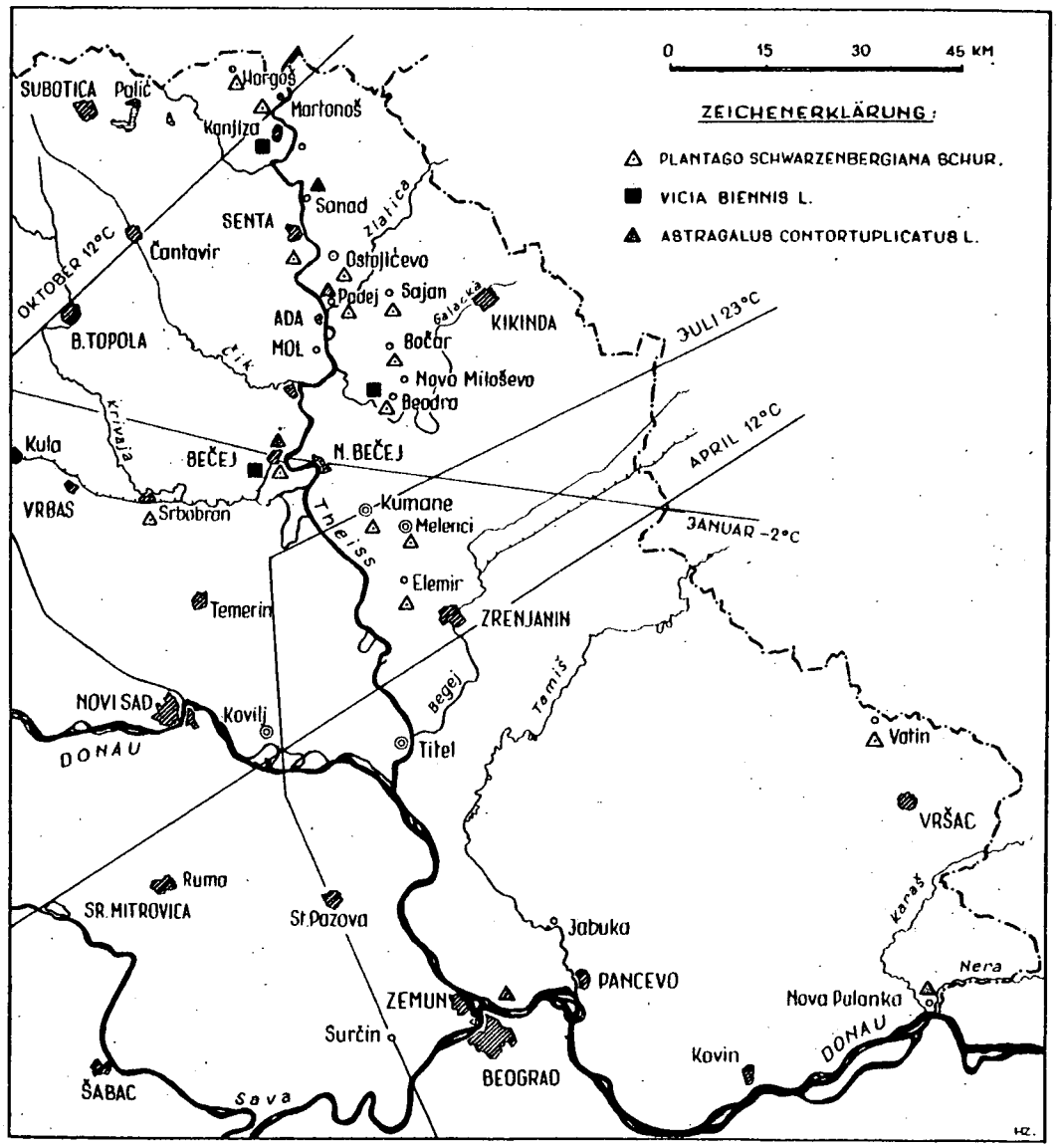
Die angeführten drei Vorkommensorte der *Vicia biennis* in der Bačka und im Banat bekräftigen nochmals das über die vorangehend behandelte Art Gesagte. Auch für diese Art erstreckt sich das Areal ausschlisslich nur in der Theissgegend, und nur bis zum äussersten Grenzpunkt der Verbreitung in südwestlicher Richtung bis zu Bečej. Demgemäss fällt auch das Areal dieser Pflanze mit den Grenzen des allerdüresten Teils der Vojvodina überein.

Hinsichtlich ihrer grundlegenden Charakteristik ist den vorangehend behandelten zwei Arten ähnlich die Art:

Astragalus contortuplicatus L.

Sie ist im östlichen Teil der Balkanhalbinsel verbreitet, sowie in Mittel- und Südrussland, ferner in Westasien /J á v o r k a 1925/, doch kommt sie nicht bis zum Mittelländischen Meer heraus. /S o ó 1966/, was offensichtlich darauf hinweist, dass auch diese eine kontinental-pontische Art sei.

In der Flora der Vojvodina wird sie seitens P r o d á n angeführt,



Die Verbreitung der Arten *Plantago Schwarzenbergiana* S c h u r., *Vicia biennis* L., *Astragalus contortuplicatus* L. in Vojvodina.

auf Grund von Angaben von K o v á c s , der sie in der Umgebung von Bečej aufgefunden hat /P r o d á n 1916/. Zwei weitere Vorkommensorte wurden durch S l a v n i ć aufgezeichnet, und zwar im Banat in der Gegend von Sanad und Padej, wo diese Pflanze nur in den Überschwemmungsbereichen der Theiss wächst /S l a v n i ć 1943/. Über das Vorkommen dieser Art im äussersten südöstlichen Teil des Banats besteht eine sehr viel frühere Angabe bei H e u f f e l, der sie in der Gegend von Neu Palanka, an dem Donauufer vorfand /H e u f e l 1858/. Ich hatte eine Pflanze aus diesem Standort in der Sammlung europäischer Pflanzen des Museums in Sarajevo zu sehen Gelegenheit gehabt. Zusammen mit dieser Pflanze befinden sich auch andere Pflanzen aus der Umgebung von Beograd, welche unsere renomierten Botaniker J u r i š i ć /1890/ und A d a m o v i ć /1904/ gesammelt hatten.

Aus Obigen lässt sich der Schluss ziehen, dass die Verbreitung der Art *Astragalus contortuplicatus* in der Theissgegend mit dem Areal der Pflanzen *Vicia biennis* und *Plantago Schwarzenbergiana* zusammenfällt und dass auch für sie dieselbe Verbreitungsgrenze in westlicher Richtung besteht. Die letzangeführten drei Standorte jedoch zeigen eine etwas abweichende Abgrenzung des Areals in südlicher Richtung, nämlich bis zum Flusstal der Donau.

Zusammenfassung

Alle drei der von uns untersuchten Arten stimmen hinsichtlich der Areale insofern überein, als die Verbreitung in westlicher Richtung an einer scharfgezeichneten Grenzlinie abrupt zu Ende kommt, welche entlang der Theiss, vom Eintritt dieses Flusses in unser Land angefangen, in deren Tal verlauft. Hinsichtlich der Arten *Plantago Schwarzenbergiana* und *Vicia biennis* endet diese Grenzlinie ungefähr in der Höhe der Stadt Bečej, während die *Astragalus contortuplicatus* etwas weiter gegen den Süden vordringt und die Grenze im allgemein entlang des Laufes der Donau liegt.

Die Schärfe der Abgrenzung des Areals sowie die Abwesenheit von extrazonalen Vorkommen in westlicher Richtung lässt sich am ehesten mit gewissen klimatischen Gegebenheiten in Zusammenhang bringen. Dass es sich nicht um die Bodenbeschaffenheit handelt, ist daraus ersichtlich, dass weder die *Vicia biennis* noch der *Astragalus contortuplicatus* an eine specifische Bodenbeschaffenheit gebunden sind. Was die *Plantago Schwarzenbergiana* anbelangt, welche eine ausgeprägt halophytische Pflanze ist, ist es auch nicht die Beschaffenheit des Bodens, welche einer weiteren Ausbreitung nach dem Westen eine Grenze setzt, wie dies vorangehend bei der Beschreibung dieser Pflanze ausführlich dargestellt wurde.

Eine ganz genaue Fixierung der westlichen und südlichen Grenzen dieser drei Pflanzen trägt zur besseren Charakterisierung und einer schärferen gegenseitigen Abgrenzung gewisser pflanzengeographischen Gebiete der Vojvodina bei. Vorliegende Arbeit war dabei behilflich, die Grenzlinie zwischen dem C r i s i c u m und dem T i t e l i c u m festzulegen. Anderseits bestätigen die auf alle drei Arten bezüglichen Daten die Richtigkeit der Grenzlinie zwischen den Gebieten östlich der Theiss, beziehungsweise dem Gebiet zwischen den beiden Flüssen, und ebenfalls auch jene zwischen den Florengebieten Deliblato bzw. Titel.

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Die Rhizopodenfauna der ungarischen Strecke der Theiss und des Mündungsteiles ihrer Nebenflüsse

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Auszug

In den vergangenen zehn Jahren habe ich aus verschiedenen Strecken der Theiss und den Mündungsstrecken ihrer Nebenflüsse in verschiedenen in verschiedenen Zeitpunkten /im Frühling, Sommer, Herbst, Winter/ zusammen 827 Planktons, Schlamm und Abschabselmuster gesammelt. Aus dem gesammelten Stoff vermochte ich 69 *Rhizopoda*-Arten zu erweisen, deren Verteilung die folgende ist:

Obertheiss	33 Arten
Staustrecke der Theiss	27 "
Niedertheiss	44 "
Aus den Nebenflüssen zusammen	48 "

Von den in den Nebenflüssen gefundenen 48 *Rhizopoda*-Arten kamen elf in der Theiss nicht vor.

Aus dem gesammelten Stoff habe ich auch eine neue Art - *Euglypha tiscia* - beschrieben /1969/.

Die ungarische Strecke der Theiss kann aus hydrologischen Gesichtspunkt in drei - voneinander gut abgesonderte - Teile geteilt werden:

1. O b e r e S t r e c k e : Von Tiszabecs bis zu Dombrád. In den ersten 17 km ist das Flussbett kieselig, die Wasserlaufgeschwindigkeit sehr gross. Hier in den meisten Fällen ist das Wasser rein, seine Durchsichtigkeit erreicht selbst 2 Meter /mit Secchi-scher Scheibe gemessen/. Später ist das Flussbett sandig, das Wasser enthält vielen angeschwemmten Sand der starken Turbulenz zufolge, seine Durchsichtigkeit ändert sich nur zwischen 10 und 30 cm. In dieser Strecke ist die Schwankung der Wasserhöhe gross und schnell, sie ändert sich oft selbst 1 m stündlich.

2. D e r v o m W a s s e r k r a f t w e r k z u T i s z a l ö k k ü n s t l i c h z u r ü c k g e s t a u t e T e i l : von Dombrád bis zu Tiszalök. Hier vermindert sich die Ablaufgeschwindigkeit des Wassers, das Flussbett verbreitet sich. Das Wasser enthält weniger angeschwemmten Stoff, seine Durchsichtigkeit erreicht selbst 50-60 cm. Stellenweise hat es einen wahren Stillwassercharakter, seine Ufer sind von Pflanzen bedeckt worden /Rohr, Schilfgras, usw./, die für die Stillwässer bezeichnend sind. Der

Regulierungswirkung des Wasserkraftwerks zufolge ist die Schwankung der Wasserhöhe langsam und unbedeutend, kaum 1 m, den vorigen 10 Metern gegenüber.

3. D i e T h e i s s s t r e c k e u n t e r T i s z a l ö k : Das Flussbett ist überall sandig, in kleineren Flecken tonig. Die Turbulenz ist sehr stark. Das Wasser ist von den angeschwemmten Sandkörnchen ständig grauisch gelb, seine Durchsichtigkeit ist klein, ändert sich zwischen 10 und 30 cm.

Das pH des Wassers fluktuiert in allen Theissstrecken im allgemeinen um 6,7-6,8.

Ihre Nebenflüsse sind abwechslungsvoll in Grösse und Aufbau:

1. S z a m o s : Ihr Mündungsteil fliesst der Theiss ähnlich in einem sandigen, tonigen Flussbett, das Wasser ist trüb, es enthält viele Anschwemmungsstoffe /besonders viele kolloidale Anschwemmungsstoffe/. Breite bei der Mündung ist 30-40 m, durchschnittliche Wassertiefe 70-80 cm.

2. K r a s z n a : Sie mündet 4 km unter der Szamos in die Theiss, sie ist im grössten Teil des Jahres ein schmales, 2-3 m breites, 50 cm tiefes Bächlein. Nur im Fall grösserer Regen befördert sie eine bedeutendere Wassermenge. Ihr Wasser ist in den meisten Stellen rein, durchsichtig, im Flussbett gibt es viele Wasserpflanzen.

3. B o d r o g : Da sie nur 15 km über dem Wasserstau zu Tiszalök ist, kann die Stauung auch in der Bodrog stark gefühlt werden. Die Wasserlaufgeschwindigkeit ist klein, sie ist durchschnittlich zwischen 1-1,5 m. Das Wasser ist im allgemeinen rein, zeitweise ganz braun, wenn das an ihr Ufer angesiedeltes Lederwerk viel Gerbereiabwasser hineinfliessen läst.

4. Östlicher Hauptkanal: Der ist ein künstlich gebauter, 20-25 m breiter Bewässerungskanal 2-3 m durchschnittlicher, Wassertiefe der von der Theiss über dem Wasserkraftwerk zu Tiszalök entspringt und bei Bakonszeg in die Berettyó mündet. In dem 100 km langen Kanal hängen Wasserhöhe und Flussgeschwindigkeit davon ab, wieviel Wasser bei der von der Theiss 4,7 km fern befindlichen Schleuse zu Tiszavasvár aus der Theiss durchgelassen wird. Die durchgelassene Wassermenge fluktuiert zwischen 0 und 50 m^3/sec. Sein Ufer wird hie und da von einem Rohrgebüsch umrandet.

5. S a j ó : Sie ist ein kontaminierter Fluss trüben Wassers, mit kleiner Wasserabgabe. Ihr Mündungsteil fliesst in einem sandigen Flussbett, enthält vielen angeschwemmten Stoff.

6. Z a g y v a : Sie ist im grössten Teil des Jahres schmal /10-20 m breit/, seichten Wassers /80-100 cm tief/, bei einer Überschwemmung aber mag die Wasserhöhe selbst 8-10 m ansteigen. Ihr Wasser ist kontaminiert, besonders vom Abwasser eines Zuckerwerks.

7. K ö r ö s : Einer der grössten Nebenflüsse der Theiss. Ihr Wasser ist im allgemeinen rein, durchsichtig und nur in der Zeit der Überschwemmungen trüber.

8. M a r o s : Sie ähnelt der Theiss am meisten, fliesst in einem sandigen Flussbett, deshalb enthält ihr Wasser, der Theiss ähnlich, beinahe ständig vielen angeschwemmten Stoff. Sie ist schnellen Laufs, in grösstem Teil des Jahres mit seichtem Wasser.

Sammlungs und Untersuchungsmethoden

Im Laufe der abgelaufenen zehn Jahre habe ich aus den verschiedenen Teilen der Theiss und der Mündungsstrecke ihrer Nebenflüsse, in den verschiedensten Zeitpunkten /im Frühling, Sommer, Herbst, Winter/ zusammen 827 Planktons, sowie Schlamm- und Abschabselmuster gesammelt. Ein Teil des bearbeiteten Stoffes ist schon eingehend veröffentlicht worden /1961a, 1961b, 1963, 1964, 1966, 1969/.
In diesen Abhandlungen habe ich mich über die genaue Besprechung der einzelnen Sammelstellen ausgebreitet, somit sehe ich davon hier ab.

Die Sammlungen habe ich in den verschiedenen Jahreszeiten immer in denselben Stellen durchgeführt /die Sammelstellen sind in Abb.1 dargestellt/. Bei der Mündung der Nebenflüsse habe ich aus der Theiss sowohl über als auch unter der Mündung des Nebenflusses gesammelt, um auch die Wirkung des Nebenflusses nachweisen zu können.

Einen Teil des gesammelten Stoffes habe ich in 1-2 Stunden nach der Sammlung bearbeitet, um auch die blossen Amöben bestimmen zu können, den änderen Teil habe ich mit Formalin konserviert. Nachdem mein Zweck war, die in der Theiss lebenden *Rhizopoda*-Arten zu bestimmen, habe ich während der Bearbeitung nur die im Moment der Durchführung der Sammlung in lebendigem Zustand gefundenen Arten aufgezeichnet, die leeren Schalen, Schalfragmente, Zysten habe ich ausser Acht gelassen.

Bewertung der erhaltenen Ergebnisse

Die obere Theissstrecke:

In der oberen Theissstrecke Ungarns sind 33 *Rhizopoda*-Arten zum Vorschein gekommen, von denen sechs /*Astramoeba radiosa* var, *granulifera* P e n a r d , *Difflugia mammillata* P e n a r d, *Difflugia elegans* P e n a r d, *Lecqureusia spiralis* E h r e n b e r g , *Arcella costata* E h r e n b e r g, *Nebela collaris* L e i d y/ habe ich in den anderen Theissstrecken nicht gefunden. Die häufigsten und mit den grössten Einzelanzahl vorkommenen Arten sind die *Centropyxis constricta* D e f l a n d r e, *Arcella discoides* E h r e n b e r g und die *Arcella rotunda* var. *aplanata* D e f l a n d r e .

Ich habe in den in diesen Strecken einmündenden zwei Nebenflüssen zusammen 24 Arten gefunden in der folgenden Verteilung: in der Szamos 17,

in der Kraszna 19 Arten.

In der Szamos sind *Centropyxis aculeata* S t e i n und *Centropyxis constricta* D e f l a n d r e die dominierenden Arten. Die in der Szamos lebenden *Arcella hemisphaerica* P e r t y und *Cyphoderia laevis* P e n a r d kamen in dieser Strecke der Theiss nicht vor.

Die Kraszna ist sehr reich sowohl an den Arten als auch an den Einzelorganismen. Dominante Arten sind die *Difflugia amphora* L e i d y, *Arcella rotunda* var. *aplanata* D e f l a n d r e , *Arcella gibbosa* P e n a r d, die in allen Sammlungen meistens mit grosser Anzahl der Einzelwesen vorkamen. Von den in der Kraszna lebenden *Rhizopoda*-Arten haben wir in der Obertheiss die *Difflugia oviformis* P e n a r d und *Difflugia sp.* I. und II. nicht gefunden.

D e r a u f g e s t a u t e T e i l d e r T h e i s s :

Von der aufgestauten Bettstrecke zwischen Dombrád und Tiszalök vermochte ich 27 *Rhizopoda*-Arten aufweisen, von denen *Difflugia curvicaulis* P e n a r d , *Phryganella paradoxa* P e n a r d, *Cyphoderia margaritacea* var. *major* P e n a r d, *Cyphoderia trochus* P e n a r d und *Difflugia sp.* III. in den anderen Theissstrecken nicht vorkamen. Die am häufigsten und mit der grössten Anzahl der Einzelwesen vorkommenden Arten sind: *Arcella rotunda* var. *aplanata* D e f l a n d r e , *Centropyxis aculeata* S t e i n und *Difflugia gramen* P e n a r d .

Die Bodrog ist sehr arm sowohl an der Zahl der Arten als auch an der der Einzelwesen. Die wahrscheinliche Ursache davon ist, dass ihr Wasser oft mit gerbsäuringen Gerbereiabwasser kontaminiert ist. Im Fall einer grösseren Menge von Schmutzstoffen kommt die ganze lebendige Welt um /dann wird die Oberfläche des Wassers von Fischkadavern bedeckt/. 11 *Rhizopoda*-Arten kamen vor, von denen nur die *Arcella rotunda* var. *aplanata* D e f l a n d r e öfters und in einer grösseren Einzelzahl gefunden war; die anderen Arten erscheinen nur sehr sporadisch. Eine jede der in der Bodrog vorkommenden Arten kann auch in der Theiss gefunden werden.

Im östlichen Hauptkanal habe ich 20 *Rhizopoda*-Arten gefunden. Die meistverbreiteten sind: *Centropyxis aculeata* S t e i n und *Centropyxis consitricta* D e f l a n d r e , die beinahe bei jeder Gelegenheit überall zu finden sind. Von den in östlichen Hauptkanal gefundenen Arten kamen *Difflugia mammalita* P e n a r d , *Difflugia elegans* P e n a r d , *Arcella vulgaris* E h r e n b e r g , *Hyalosphaenia papillo* L e i d y , *Euglypha alveolata* L e i d y , *Euglypha brachiata* L e i d y in dieser Strecke der Theiss nicht vor.

D i e u n t e r e T h e i s s s t r e c k e :

In der unteren Theissstrecke können die Rhizopoden hinsichtlich sowohl der Anzahl der Arten wie der Einzelwesen in der grössten Menge gefunden werden. Von den hier vorgekommenen 44 *Rhizopoda*-Arten habe ich in den anderen Theissstrecken 15 Arten nicht gefunden. Diese grosse Artenanzahl und der

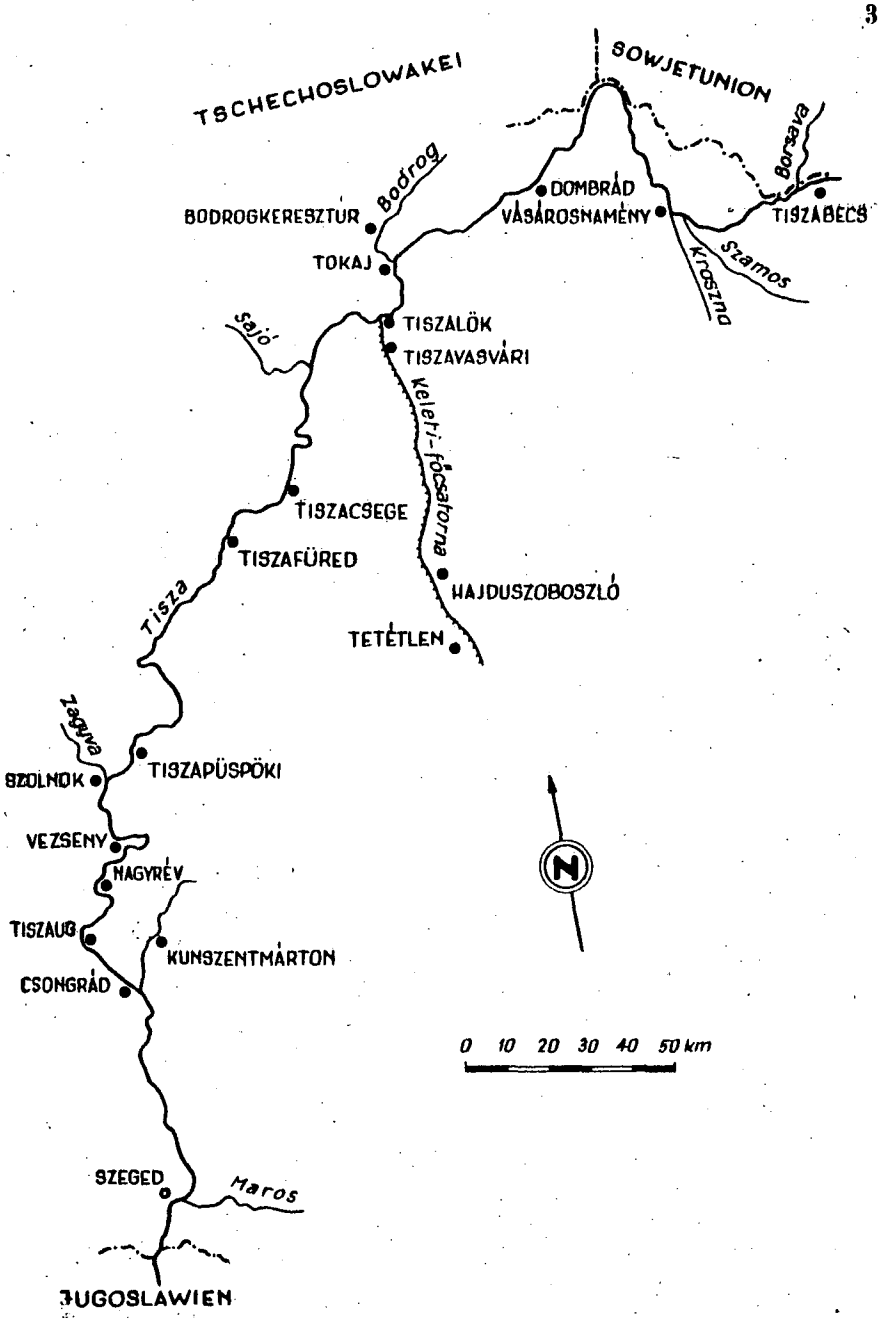

Fig. 1: Schematische Karte der Theiss mit Bezeichnung der Sammlungsstellen.

grosse Unterschied lässt sich damit erklären, dass teils diese Theissstrecke viel länger und differentiierter ist, und auch mehrere konteminierte Teile enthält /die Sajó und Zagyva bringen nämlich sehr viel Abwasser mit, auch die Schmutzstoffe des Wärmekraftwerks von Tiszanalkonya und die der Werke unter Szolnok, usw. sind bedeutend/, teils es auch mehrere kleinere Wassereinflüsse gibt, die viele Arten in die Theiss mitbringen. Sehr bedeutend sind die städtischen Abwässer der in dieser Strecke befindlichen Grossstädte, die in die Theiss organische Stoffe liefern, die für die inferioren Tiere eine gute Ernährungsmöglickeit sichern. Sie liefern ausserdem natürlich auch viele Krankheitserreger, die im Wasser des Flusses noch eine gewisse Zeit lang weiterleben. Dazu gehört z.B. die *Entamoeba coli* /L ö s c h/ S c h a u d i n n , die im Schmutzkanal zu Szeged sehr häufig ist und zeitweise auch in der Theiss in grosser Menge erwiesen werden kann, im Teil unter dem Schmutzkanal.

Von der Sajó habe ich sie nur bei einer Gelegenheit gesammelt. Dann dominierte die *Arcella vulgaris* E h r e n b e r g in grosser Menge, deren Wirkung auch in der Theiss beobachtet werden konnte und die Anzahl ihrer Einzelorganismen auch in der Strecke unter der Mündung des Nebenflusse stark zunahm. In der Sajó habe ich ausserdem nur zwei, bzw. eins der Einzelorganismen der *Difflugia gramen* P e n a r d und *Arcella discoides* E h r e n b e r g gefunden.

Von den 17 in der Zagyva vorgekommenen Arten konnten *Amoeba beryllifera* P e n a r d, *Mayorella vespertilio* P e n a r d, *Difflugia corona* W a l l i c h. und *Difflugia sp.* IV. in dieser Theissstrecke nicht erwiesen werden. In den Sommersammlungen dominierten im allgemeinen: *Arcella rotunda* var. *aplanata* D e f l a n d r e, *Cyphoderia margaritacea* E h r e n b e r g und *Trinema lineare* P e n a r d, und in den Herbstsammlungen *Cocevia obscurum* P e n a r d .

Von den in den Körös befindlichen 11 *Rhizopoda*-Arten haben *Vahlkamphia limicola* R h u m b l e r und *Trinema lineare* P e n a r d dominiert. Die hier gefundenen *Amoeba alveolata* /M e r e s c h o w s k y/ P e n a r d , *Difflugia mamilleata* P e n a r d und *Pseudodifflugia fasciculatis* P e n a r d kamen in der unteren Theissstrecke nicht vor.

Von den Nebenflüssen ist die Maros an Rhizopoden am reichsten. Von den vorgekommenen 26 *Rhizopoda*-Arten ist die *Arcella rotunda* var. *aplanata* D e f l a n d r e die häfigste. Von den hier lebenden Arten sind *Mayorella vespertilio* P e n a r d , *Difflugia mammillata* P e n a r d , *Difflugia lobostoma* L e i d y, *Difflugia sp.* V. und *Hyalosphenia papilio* L e i d y in der unteren Theissstrecke nicht vorgekommen.

Zusammenfassung

Ich vermochte aus der ungarischen Theissstrecke und aus ihren Nebenflüssen bisher 69 *Rhizopoda*-Arten aufweisen /Vgl. Tabelle/. Von diesen

sind in der Theiss 58 Arten und 14 Arten von ihnen in allen den drei Strecken vorgekommen. Die häufigsten waren: *Arcella rotunda* var. *aplanata* D e f l a n d r e , *Centropyxis aculeata* S t e i n, *Centropyxis constricta* D e f l a n d r e und *Cyphoderia margaritacea* E h r e n b e r g . Diese kamen im allgemeinen in den meisten Sammelstellen vor, oft mit sehr hoher Einzelanzahl. Die anderen Arten waren im allgemeinen nur mit wenigeren Einzelorganismen zu finden. Die umbestimmbaren Arten, deren Beschreibung in meinen vorigen Abhandlungen veröffentlicht wurde, kamen nur bei 1-1 Gelegenheit, mit wenigen Einzelorganismen vor.

Ein Teil der in der untersuchten Strecke lebenden Arten ist auf Grund der literarischen Angaben /G r o s p i e t s c h /1958/ und H a r n i s c h /1961/ Kosmopolit, der grössere Teil der Arten ist aber wohnhaft im Stillwasser, unter Moos und Sphagnum. Eine ausgesprochene Flusswasserart ist nur *Vahlkampfia debilis* J o l l o s, gefunden nur in der unteren Theissstrecke.

Nach Untersuchung der Altwässer und Arbeitgruben der Theiss wurde es klar, dass in diesen Altwässern und Gruben meistens dieselben *Rhizopoda*-Arten leben, wie in der Theiss. Es ist anzunehmen, dass diese Arten von hier in die Theiss geraten sind. Nachdem sie aber im Fluss bei vielen Gelegenheiten und in langen Strecken zu finden sind, ist es wahrscheinlich, dass sie im Flusswasser weiterleben und sich vermehren. Besonders sichern die flachen Sandufer und Flacken mit langsam fliessendem seichtem Wasser günstige Lebensumstände für die Rhizopoden. Im Laufe der Untersuchungen habe ich eine sehr interessante Erscheinung beobachtet: in dem auf den Objektträger gelegten zu untersuchenden Stoff hat der grösste Teil der aus dem Flusswasser stammenden *Rhizopoda*-Arten ihre *Pseudopodia* beinahe sofort gereckt, die aus dem Stillwasser stammenden Arten hingegen erst nach einer längeren Zeit. Dies deutet darauf, dass die im Flusswasser lebenden Arten sich an die ständige Bewegung durch die Strömung des Flusses "gewöhnt" haben. Auch dies beweist, dass sich eine *Rhizopoda* Fauna endogenen Ursprungs selbst in einem Flusswasser - und so auch in der Theiss und ihren Nebenflüssen - ausbilden kann. Einige, nur in einzelnen Stellen und mit kleiner Einzelorganismenzahl vorkommende Arten hingegen, wie z.B. *Lecquereusia spiralis* E h r e n b e r g , *Nebela collaris* L e i d y, *Hyalosphenia papilio* L e i d y , die hauptsächlich Moos und Snhagnumbewohner sind, haben das Flusswasser sicherlich nur für eine sekundäre Lebenstelle. Diese geraten von den naheliegenden Altwässern und Stillwässern in den Fluss und "vegetieren" dort eine Weile.

In den Nebenflüssen habe ich zusammen 48 *Rhizopoda*-Arten gefunden, wovon elf in der Thiess nicht vorkamen. In den Nebenflüssen ist die Anzahl der Arten - im grössten Teil der Fälle - viel kleiner als in der Theiss; die Anzahl der Einzelorganismen ist hingegen in den meisten Fällen höher, besonders in den kleineren Nebenflüssen, wie die Kraszna, Zagyva. Die Nebenflüsse verursachen keine wesentliche, erweisbare Änderung in der Rhizopoden fauna der Theiss. Es konnte in der Theiss nur bei einer Gelegenheit erwiesen werden, dass die Anzahl der Einzelorganismen der *Arcella vulgaris* E h r e n b e r g in der unter der Sajómündung befindlichen Strecke sehr stark erhöht wurde.

Aus der Theiss und ihren Nebenflüssen ist während der Untersuchungen auch eine neue Art vorgekommen, die *Euglypha tiscia* G á l, deren eingehendere Beschreibung und die Stellen ihres bisheringen Vorkommens ich /in 1969/ veröffentlicht habe.

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Tabelle

Die in der Theiss und ihren Nebenflüssen lebenden Rhizopoden-Arten	Obertheiss	Stautheiss	Niedertheiss	Szamos	Kraszna	Bodrog	Östlicher Hauptkanal	Sajó	Zagyva	Körös	Maros
Vahlkampfia limax Dujardin	+		+						+		+
Vahlkampfia debilis Jollos			+								
Vahlkampfia guttula Dujardin		+	+			+					
Vahlkampfia limicola Rhumbler		+	+							+	+
Vahlkampfia mira Gläser			+								
Mayorella vespertilio Penard	+	+		+					+		+
Astramoeba radiosa Dujardin	+	+	+	+	+		+				+
Astramoeba rad. var. granulifera Penard	+				+						
Thecamoeba verrucosa Ehrenberg	+		+						+		
Amoeba alveolata /Mereschkowsky/ Penard										+	
Amoeba berylliffera Penard									+		
Amoeba gorgonia Penard	+	+	+				+		+		
Amoeba sp. I.			+								
Amoeba sp. II.			+								
Entamoeba coli /Lösch/ Schaudinn			+								
Pelomyxa sp.			+								
Hyalodiscus korotnevi Mereschkowsky	+	+	+	+	+						+
Penardia cometa /Penard/ Saedeleer										+	
Cocevia obscurum Penard	+	+	+	+	+				+		+
Arcella vulgaris Ehrenberg	+		+		+		+	+	+		
Arcella discoides Ehrenberg	+	+	+	+	+	+	+	+	+		+
Arcella gibbosa Penard	+	+	+	+	+	+					+
Arcella rotunda var. *aplanata* Defl.	+	+	+	+	+	+	+		+		+
Arcella hemisphaerica Perty		+	+	+		+	+				+
Arcella costata Ehrenberg	+										
Pyxidicula operculata Ehrenberg			+								
Difflugia mammillata Penard	+						+			+	+
Difflugia gramen Penard	+	+	+		+	+	+	+	+		+
Difflugia amphora Leidy	+	+		+	+	+	+				
Difflugia lanceolata Penard	+	+	+	+	+		+		+		+
Difflugia acuminata Ehrenberg		+	+				+				
Difflugia pyriformis Perty	+	+	+								
Difflugia globulosa Dujardin			+								
Difflugia oviformis Penard			+		+						
Difflugia elegans Penard	+						+				
Difflugia curvicaulis Penard		+									
Difflugia corona Wallich									+		
Difflugia avellana Penard			+								
Difflugia lobostoma Leidy											+
Difflugia sp. I.					+						
Difflugia sp. II.					+						
Difflugia sp. III.		+									
Difflugia sp. IV.									+		
Difflugia sp. V.											+
Difflugia sp. VI.			+								
Difflugia sp. VII.			+								
Difflugia sp. VIII.			+								
Centropyxis aculeata Stein	+	+	+	+	+	+	+			+	+
Centropyxis constricta Deflandre	+	+	+	+	+		+		+		+
Centropyxis arcelloides Penard	+		+	+							+
Pontigulasia spectabilis Penard	+	+			+	+					
Lecquereusia spiralis Ehrenberg	+										
Nebela collaris Leidy	+										
Hyalosphenia papilio Leidy							+				+
Phryganella paradoxa Penard		+									
Cryptodifflugia oviformis Penard			+								

Die in der Theiss und ihren Nebenflüssen lebenden Rhizopoden-Arten	Obertheiss	Stautheiss	Niedertheiss	Szamos	Kraszna	Bodrog	Östlicher hauptkanal	Sajó	Zagyva	Körös	Maros
Euglypha alveolata Dujardin	+		+	+			+			+	+
Euglypha ciliata Ehrenberg	+		+								+
Euglypha brachiata Leidy	+		+				+			+	+
Euglypha laevis Perty	+		+	+	+						
Euglypha tuscia Gál		+	+				+				
Trinema lineare Penard	+	+	+			+			+	+	+
Trinema enchelys /Ehrenberg/ Leidy	+		+							+	+
Pareuglypha reticulata Penard	+		+							+	+
Cyphoderia laevis Penard			+	+					+		
Cyphoderia margaritacea Ehrenberg	+	+	+	+	+	+	+		+		+
Cyphoderia marg. var. *major* Penard		+									
Cyphoderia trochus Penard		+					+				
Pseudodifflugia fasciculáris Penard										+	

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Data to the ornithological conditions of the inundation area Tiszafüred-Kisköre

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Abstract

Owing to the activity of man, transforming his surroundings, several biologically valuable areas become desolate, with their interesting animal and vegetable kingdoms. Also the inundation area in question that we can demarcate with the line Tiszafüred-Abádszalók-Kisköre-Poroszló, is like that. The whole area will be inundated by the water of Tisza dammed un. That is the cause of my trying to immortalize as much as possible of the animal kingdom of the area. I have performed collections in all the types of biotops borrow-wood in the inundation area, old willow-plantations, noble poplars, native poplars, wood of acacias and of ashtrees, orchards, meadows and pastures studying the quantitative and qualitative composition of the ornithofauna and their role in the biological protection of their environment.

In the course of analysing several collections, I have established that the inundation area is occupied first of all by xerophilous species. The birds living in the woods are dominant both in respect of the number of their species and in that of the number of individual specimens. Mainly those breeding on the level of the leafy crown and of the stem of tree are to be found in a high number. The mass of the species - 50-75 p.c. - are insectivores. The mass of the food consumed can be concluded from analysing the relations of weight dominance. Here have the herbivores a major role, being species of bigger bodies. The colonies of *Corvus frugilegus* L. mean a special problem. If the woods ensuring their settling down are eradicated, they cannot help being concentrated in the agricultural areas becoming in this way possibly parasites there.

Man considers as a task to transform his environs, for obtaining the most from it. As a consequence of that activity a lot of areas that are important biologically and from the point of view of cultural history, as well as a number of animal and plant species perish. To satisfy our conscience, even if we cannot save them, we ought to describe everything about them for informing our children's children about them. An area like that is that mentioned above, demarcated by the line of Tiszafüred-Abádszalók-Kisköre-Poroszló and investigated by me /Cf.Fig.1./. The water dammed un by the river barrage Tisza II that is being built at Kisköre will entirely inundate the part being between the present dams und thus one of the huge inundation areas of our country perishes together with its characteristic flora and fauna. The purpose of this paper is, therefore, first of all to collect as many data as possible and to immortalize them concerning the avifauna of the area.

Methods of investigation:

With regard to the large extent of the area, I could not overlook systematically every small part of it. But it was not necessary, either. My method was to carry out collections from every type of biotops occurring in the inundation area: borrow-wood in the inundation area, old willow-plantations, old poplars, planted, orchards, wood of acacias and of ashtrees, native poplars, meadows and pastures. I performed in a type, of course, more collections, for getting a picture of the characteristic avifauna. The collections - counting the species and individual specimens - were performed on two hectares in the wood and orchard /100 x 200 m/. At the meadows and pastures, on the other hand, I have ranged an area of 50 hectares or so /1000 x 500 m/. On the basis of the observed specimens, singing males and discovered nests, I have endeavoured to establish the number of species and individual specimens living in the area considered as a unit. This datum served for basis for further analyses. At the species breeding in colonies, however, I have counted every nest independently from the extent of the colony.

There were, of course, some rare and remarkable species - *Ciconia nigra* L. - nesting outside the collecting area. I have counted these, too, and mentioned at the given biotop.

I carried out my observations in two aspects - in early spring and in the beginning of summer - getting in this way a more perfect picture about the avifauna.

Results of the investigation:

As I have performed the collections, too, according to the types of biotop, I wish to analyse also the avifauna in this framework. Before doing that, however, I hold as necessary to characterize shortly the single types of biotop, for being able to evaluate the world of birds in their connection with their environs.

Wood at the borrows. It accompanies the inundation dams, having come into being in the borrow area as these dams were built. It is formed mainly by the *Populus alba* L. and *P. tremula* L., both of gigantic growth, overgrown by *Vitis silvestris* G m e l. It is accompanied on the inner side of the dam generally by a zone of old, hollow, truncated willow-plantation. The underwood is *Rubus caesius* L., the shrub level *Amorpha fructuosa* L.

Old willow-plantations of pure stand. They occur in a comparatively not large extent and only in spots in the area. They are formed mainly by *Salix alba* L., with several old, hollow exemplars. This wood type may have been the old autochthonous association of the inundation area that later was ousted by the artificial afforestation. In its underwood *Rubus caesius* L. and *Urtica dioica* L. can be found.

Noble poplars planted. This is the wood type taking the largest area. In the shrub level *Amorpha fruticosa* L. is mostly growing in an extremely dense stand. The oldest plant may be 25-30 years old. There are planted first of all the giant, Italian, French and koari poplar species.

A c a c i a g r o v e s . I have discovered them only in a single considerable continuous area, planted along the mortlake at Cserőköz between Tiszaderzs and Tiszaszőllős. Here they are, anyway, in an area of about 100 hectares, being worth while mentioning and investigating.

A s h - w o o d s. There are planted comparatively large areas with *Fraxinus excelsior* L. Its continuous stands of major extent can be found in the large inundation area at Tiszafüred-Poroszló.

N a t i v e p o p l a r s . They are the second, probably autochthonous association of the inundation area, formed by old *Populus alba* L. of giant growth and here and there also by *P. tremula* L. Their age may be at least 70-80 years. They occur in comparatively small spots /2-3 ha/ and only in 2-3 sites. I am mentioning them because of their typical inundation character and fauna. They are before being driven out.

O r c h a r d s . They occur in several places of the inundation area in smaller or larger spots, being formed mainly by plum- and apple-trees. They have, almost without any exception, an old, hollow stands, in the high percentage of cases in a neglected state.

M e a d o w . There are wet meadows in a great extent, variegated with a considerable amount of willow and poplar shrubs and trees. The latter ones have a great influence on the composition of the fauna therefore I do investigate them separate from the next bioton.

P a s t u r e . It is perhaps the bioton of the largest extent. They are treeless grass-lands, first of all for grazing. They may be found in the largest continuous piece at the Sarudi meadow. In some deeper parts of it the hydrofilous flora and fauna components are concentrated. The depressions are, however, dry in June, and the birds are attracted there only by the bulrush and reeds.

I did not speak separately about the planted oak woods that can be found in the area, too, because they are mostly of young stand and their avifauna here is similar to that of ash-woods. The avifauna of mortlakes has similarly not been investigated, because the species living here will be touched only a little or not at all by the coming changes.

The examination of *Riparia riparia* L. and *Merops apiaster* L. breeding in the steep bank-walls of the Tisza was carried out by M. Marián, therefore I do not speak about them, either.

Analysation of the avifauna

As already mentioned at discussing the methods of collection, I have performed more collections in any bioton type-related to some territorial units, for being able to establish in a given bioton the quantitative and qualitative composition of the avifauna. Having got these numerical data I could carry out the necessary statistical analysis, thus among others also the analysis of the dominance relations. In this way I could arrange the members of the avifauna know qualitatively with the help of the quantitative indices. Inside the single communities, therefore, I have distinguished - on the basis of their dominance - dominant /above 12 D p.c./, subdominant /8-11, 9 D p.c./, accessory /5-7,9 D p.c./ and rarus - rare - species /0-4,9 D p.c./. The end values have been established on the basis of local analyses.

Avifauna of the borrow woods

It is characterized by a community that is rich in species and specimens, utilizing the possibilities of the bioton comparatively well.

Dominant species: *Streptopelia turtur* L., *Fringilla coelebs* L.

Subdominant species: *Oriolus oriolus* L., *Parus maior* L., *Muscicapa striata* Pall., *Passer montanus* L.

Accessory species: *Parus coeruleus* L., *Luscinia megarhynchos* Brehm., *Sylvia atricapilla* L., *Sturnus vulgaris* L.

Rare species: *Falco subbuteo* L., *Columba palumbus* L., *Cuculus canorus* L., *Coracias garrulus* L., *Picus viridis* L., *Dendrocopos maior* L., *Corvus cornix* L., *Chloris chloris* L. This nesting community is throughout characteristic of the borrow woods in the region investigated by me. Exceptions are only the wood part where *Corvus frugilegus* L., colonies came about. From the members of the above mentioned community some perish - *Falco subbuteo* L., *Picus viridis* L., *Dendrocopos maior* L. and new ones are substituting them - *Falco tinnunculus* L., *Sylvia curruca* L., *Phoenicurus phoenicurus* L., *Phasianus colchicus* L., The difference between the two communities appears rather in the obvious change in the dominance conditions. It is probable that the single species respond in a different way to the noisy vicinity of the *Corvus frugilegus* L., presenting itself in the same place, and that results in the change of the dominance relationship.

The bird species living in the borrow woods hatch on the four nesting levels available for them. 8,7 p.c. of the species hatch on the soil level, 13 p.c. in the shrub, 34,9 p.c. on the stems of trees and 43,4 p.c. in the foliage. I regard as particularly important the high percentage of the species hatching on the level of stems because they are, without excention, very useful and important insectivorous birds that live in hollows. Just after them, I have to refer to the distribution according to food, as well. 52 p.c. of the species of this bioton is insectivorous, 8,7 p.c. carnivorous, 21,8 p.c. herbivorous, and 17,4 p.c. of mixed nourishment. The high percentage of the insectivores refers to the great significance of the community for the forest economy. Its real value appears, however, only after the complex relationships of weight dominance being investigated. A conclusion may namely be drawn from that not only concerning the quality of the food consumed but also as to its quantity what is very important for us. On this bases, the insectivores have a weight dominance of 40 p.c., the carnivores of 6 p.c., the herbivores of 36 p.c., and those with mixed food of 18 p.c. These numerical data are more or less in harmony with the above-mentioned indices.

It is, anyhow, a modified situation in the woods where there are crow nests. Here belongs 95-99 p.c. of the weight dominance to those with mixed food, and all the other nourishment forms present themselves only in fractions of the percentage. That is important because in the given situation - just as a consequence of the mixed food - the denizens of the plantation do touch keenly the agricultural production. This conserns, anyway, every crow colony in the inundation area. I will return separately to that problem later on.

Avifauna of the old willow plantations of pure stand

This is the biotop which is richest in species in the investigated inundation zone. The cause of that is, as I see, that as a characteristically inundation wood-type, it corresponds the most to the avifauna of the inundation area. The great lot of hollow old trees, the comparatively dense underwood ensure extremely favourable conditions for settlements.

D o m i n a n t s p e c i e s : *Streptopelia turtur* L., *Passer montanus* L., *Parus maior* L., *Fringilla coelebs* L.

S u b d o m i n a n t s p e c i e s : *Oriolus oriolus* L., *Sylvia atricapilla* L., *Muscicapa striata* P a l l .

A c c e s s o r y s p e c i e s : *Columba palumbus* L., *Picus viridis* L., *Turdus merula* L., *Luscinia megarhynchos* B r e h m .

R a r e s p e c i e s : *Phasianus colchicus* L., *Dendrocopos maior* L., *Corvus cornix* L., *Pica pica* L., *Parus caeruleus* L., *Aegithalos caudatus* L., *Certhia barchidactyla* B r e h m ., *Phoenicurus phoenicurus* L., *Locustella fluviatilis* W o l f., *Sturnus vulgaris* L.

In the areas of that biotop type, outside the site of collections, I have found a pair of nesting *Falco subuteo* L., and some *Ciconia nigra* L. In the nest of the latter one there were two young ones.

The utilization of the nesting levels of the biotop is the best and the most balanced. 9,1 p.c. of the species hatches on the soil-level, 22,7 p.c. in the shrubs, 36,4 p.c. on the tree stems and 31,8 p.c. of them on the foliage level. Here is the percentage of the hollow-dwellers the highest, and if we add that even the number of their individual specimens is not low, then their importance considerably grows. Our attention is drawn to that, anyway, by the distribution according to nourishment, as well. 68 p.c. of the species is insectivorous, 18,3 p.c. herbivorous, and 13,7 p.c. is of mixed nutrition. /*Falco subbuteo*, mentioned earlier, was not contained in the collection/.

The weight dominance is, at the same time, showing an absolute dominance of herbivores - eating weedseed - the distribution developing in the following way: insectivores have 31,6 p.c., herbivores 58,5 p.c., and those of mixed nutrition only 9,9 p.c. of the total weight. I have, of course, not recorded the data of the crow settlement - that occurs in this biotop type, too - because it would strongly change the conditions, giving a false picture about the avifauna of the willow-plantations.

Avifauna of the noble poplars planted

That is an entirely peculiar biotop, being extremely poor in the number of species and specimens. About the cause of that a separate monograph could be written. Here I refer only to the loose branch- and leaf-structure of the noble poplars that is not favourable for nesting and hiding. I have discovered a comparatively more "lively" bird life only in 25-30 years old poplar groves. The younger woods were characterized - in more places - by a full absence of birds.

Dominant species : *Sylvia atricapilla* L.

Subdominant species : *Streptopelia turtur* L.

Accessory species : *Oriolus oriolus* L.

Rare species : *Columba palumbus* L., *Sylvia curruca* L., *Lanius collurio* L., *Fringilla coelebs* L.,

In two sites of the collection I have discovered crow settlements, as well, but only in an older - about 20 years old - poplar grove.

The degree of utilization of the nesting levels is bad. 50 p.c. of the species hatches on the level of shrubs, 50 p.c. on that of foliage. The woods being young, there is no hollow tree, and the large and very useful group of hollow-dweller birds is, therefore, fully absent.

The distribution according to nourishment is: 57 p.c. insectivores, 43 p.c. herbivores. On the basis of weight dominance, 47 p.c. of the species are insectivores and 53 p.c. of them herbivores. Those of mixed nutrition are represented only by *Corvus frugilegus* but here I have not mentioned them.

Avifauna of acacia groves

It is rich in the number of species and individual specimens, having a dominance of warbler communities.

Dominant species : *Streptopelia turtur* L., *Fringilla coelebs* L., *Sylvia atricapilla* L.

Subdominant species : *Parus maior* L., *Luscinia megarhynchos* Brehm., *Muscicapa striata* Pall.,

Accessory species : *Columba palumbus* L., *Oriolus oriolus* L.,

Rare species : *Falco tinnunculus* L., *Phasianus colchicus* L., *Cuculus canorus* L., *Pica pica* L., *Locustella fluviatilis* Wolf., *Sturnus vulgaris* L., *Carduelis carduelis* L.

The composition and richness of the community is influenced favourably

by the wood lying along the mortlake at Cserőköz and by the fact that the stand contains also old, hollow trees.

On the four available nesting levels we have discovered hatching species although the dwellers of the foliage level are dominant. The distribution of species is as follows: 8 p.c. of the birds hatched on the soil, 17,6 p.c. of them in the shrubs, 17,6 p.c. on the tree-stem level, and 53 p.c. on the foliage level.

On the basis of the nutrition consumed, the distribution of species is as follows: 59 p.c. of them are insectivores, 5,9 p.c. carnivores, 29,2 p.c. herbivores, and 5,9 p.c. those of mixed nutrition. This acacia grove was therefore, the most favourable for the arbicolous species consuming insect nourishment.

On the other hand, the weight dominance is favourable for the category of herbivores. The cause of that is that the species belonging here are generally heavier and, even if they have a subordinate role at the investigation of the individual specimens here is their situation anyway advantageous. In the weight dominance, the insectivores are represented with 18,5 p.c., the herbivores with 63,2 p.c. the carnivores with 4,2 p.c., and those of mixed nutriture with 14,1 p.c.

Avifauna of ash-woods

In this biotop I have found even three nesting communities. Two of them - crow and heron settlements - are special, i.e., they are not characteristic of ash-woods. And the third one proved - after being counted more times - to be the poorest of all of them.

D o m i n a n t s p e c i e s : *Sylvia atricapilla* L.
S u b d o m i n a n t s p e c i e s : *Streptopelia turtur* L.
R a r e s p e c i e s : *Muscicapa striata* P a l l., *Parus maior* L.

The extraordinary poverty in number of species and specimens observed here may, perhaps, be explained by these woods being - with only one exception - young. There are scarcely, if any, hollow trees or those suitable for being hollow. The shrub level and the underwood are almost fully missing or they are very rare.

From the species discovered here one hatches on the shrub level, one of them on level of tree-stems, and two on the foliage level.

On the basis of nutrition, the insectivores have got an absolute dominance - 75 p.c. - opposed to the herbivores - 25 p.c.

The conditions of weight dominance are, however, like in a lot of other cases also here favourable for the herbivores, the insectivores giving 27,5 p.c. of the community while the herbivores 72,5 p.c. of it.

In the same way as at the earlier biotops, I don't analyse here the crow settlements.

On the other hand, I consider as necessary to make known the heron settlement. It can be found in the old ash-wood, mentioned earlier as an exception, in the inundation area at the left bank of the Tisza, between

Tiszaszőllős and Örvény. In the settlement I have discovered 34 *Ardea cinerea* L., 32 *Nycticorax nycticorax* L., 5 *Egretta garzetta* L., and 3 *Phalacrocorax carbo* L. nests. The great number of common herons /*Ardea c. cinera*/ - 31 pairs - and the cormorants /*Phalacrocorax sp*/ nested on a giant trembling poplar grown at the edge of the ash-wood. The night herons /*Nycticorax n. nycticorax*/ and little egrets /*Egretta garzetta*/ hatched, however, on the ash-trees around the poplar. It is interesting that in the same place, around the heron settlement, there was also a *Corvus frugilegus* L. settlement, populous enough.

Avifauna of native poplar woods

The native poplar woods are characterizing the large river inundation areas as much as the willow woods do. As their wood is, however, less suitable for industrial purposes than that of the noble poplars, they are driven more and more from everywhere. In the woods studied I have found a strongly mixed community of heterogeneous composition. It still conserved some elements from the species of the inundation woods of large extent but, just because of the shrinking areas, the still existing few wood-spots were occupied rather by the small singing-birds.

D o m i n a n t s p e c i e s : *Parus maior* L., *Fringilla coelebs* L.

S u b d o m i n a n t s p e c i e s : *Streptopelia turtur* L., *Oriolus oriolus* L., *Sylvia atricapilla* L.

R a r e s p e c i e s : *Milvus migrans* B o d d., *Phasianus colchicus* L., *Columba palumbus* L., *Dendrocopos maior* L., *Muscicapa striata* P a l l.

Hatching species have been found on all the four nesting levels occurring in the woods. It is to be noticed, anyhow, that here was the distribution not even. 50 p.c. of the species hatches on the foliage level, 20 p.c. on the level of tree-stems, 20 p.c. on the shrub level, and 10 p.c. on the soil level.

The distribution according to nourishment is, on the other hand, as follows: 50 p.c. of the species are insectivores, 40 p.c. of them herbivores, and 10 p.c. carnivores. As the insectivores are - even if being numerous - song-birds of small body, at calculating the weight dominance they fall considerably into the background. The herbivores have 61,4 p.c. of weights, the carnivores 28 p.c., and the insectivores 10,6 p.c. of them.

Avifauna of orchards

It is not a natural bioton. It would, in fact, be even regarded as an agricultural area. All of them are old, uncared-for, less-disturbed

fruit-gardens. There developed an avifauna with the dominance of a characteristic small song-bird, being here poorish, there richer.

D o m i n a n t s p e c i e s : *Passer montanus* L.

S u b d o m i n a n t s p e c i e s : *Parus maior* L., *Lanius collurio* L.,

R a r e s p e c i e s : *Streptopelia turtur* L., *Parus coeruleus* L., *Sylvia atricapilla* L., *Sylvia curruca* L., *Muscicapa striata* P a l l ., *Sturnus vulgaris* L., *Carduelis carduelis* L., *Fringilla coelebs* L.

The distribution of species according to nesting levels is interesting and characteristic. 36,4 p.c. of them hatch on the shrub level, 36,4 p.c. on the level of tree-stems, and 27,2 p.c. on foliage level. The neglected state of orchards is shown also by the high percentage of the species hatching on the levels of shrubs and tree-stems. Where the fruit--trees are not nursed duly, the number of insect pests increases what really attracts the insectivorous birds that settle down if the conditions are favourable. It can be explained in this way that 63,6 p.c. of the species living here are insectivores, 27,4 p.c. herbivores, and only 9 p.c. of them are those of mixed nutrition.

This absolute predominance of insectivores is, however, strongly moderated by the weight dominance, without decreasing, anyway, the value of the community. The distribution is as follows: in the total weight of the avifauna the representation of insectivores is 31,1 p.c., that of herbivores 39,8 p.c., and that of those with mixed nutrition 29,1 p.c.

Avifauna of meadows

The meadows variegated with trees, shrubs are characteristic and ancient biotops of the inundation area of Tisza. Their avifauna in the area investigated cannot be considered as too rich either in the number of species or in that of individual specimens.
This may possibly be the result of the systematic disturbance by mowing. According to the collections, in the area the following species are living:

D o m i n a n t s p e c i e s : *Passer montanus* L.

S u b d o m i n a n t s p e c i e s : *Streptopelia turtur* L., *Oriolus oriolus* L., *Sturnus vulgaris* L.

A c c e s s o r y s p e c i e s : *Lanius collurio* L., *Cuculus canorus* L.

R a r e s p e c i e s : *Perdix perdix* L., *Parus maior* L., *Fringilla coelebs* L.

The distribution of species according to nesting levels may be called even. 12,5 p.c. of them hatches on the soil, 25 p.c. on shrub level, 37,5 p.c. on the level of tree-stems and 25 p.c. on foliage level.

The overwhelming majority of species: 50 p.c. are insectivores. The percentage of herbivores is 37,6 p.c., that of those with mixed nutrition is 12,4 p.c.

At evaluating the weight dominance, the leading role have got also here - as everywhere - the herbivores. They mean 52,1 p.c. of the total weight of the avifauna, while the insectivores only 36,2 p.c., and those with mixed nutrition 11,7 p.c.

Avifauna of pastures

The treeless pastures of large extent are another characteristic open biotop of the inundation areas. Their avifauna - just owing to the almost full absence of trees and shrubs and the wet depressions occurring here and there - is quite different from that in the former biotop.

D o m i n a n t s p e c i e s : *Coturnix coturnix* L., *Alauda arvensis* L., *Emberiza citrinella* L.

S u b d o m i n a n t s p e c i e s : *Motacilla flava* L., *Emberiza calandra* L.

A c c e s s o r y s p e c i e s : *Sylvia communis* L.

R a r e s p e c i e s : *Acrocephalus scirpaceus* H e r m ., *A. schoenobaenus* L., *Anthus campestris* L.

A great number of species, 66,6 p.c. nest on the soil. Only 11,1 p.c. of them hatch on shrub level, and 22,3 p.c. on reed level. /The latter ones appear in spots of rushes and reeds/.

The distribution of species according to the nutrition consumed is: insectivores are 55,6 p.c. herbivores are 22,2 p.c., and those with mixed nutrition 22,2 p.c.

The values of weight dominance have been formed in the following way: the weight percentage of insectivores is 8,8 p.c., that of herbivores is 49,4 p.c., and that of those with mixed nutriture is 41,8 p.c.

Looking over the data described above, we may say that the area mosaic investigated is of complex character where the different biotops covered with wood and meadow are placed alternately by one another.

It is proved by the observations that the species utilize the nesting possibilities given by the biotops. The occasions being different in the various biotops, also the degree of utilization changes is harmony with that. The backbone of the avifauna is formed - independently from the character of the biotop - by the insectivores. They comprise 50-75 p.c. of the species. This group is followed by the herbivores with 18-43 p.c.,

then follow the species of mixed nutrition with 6-22 p.c., and finally the carnivores with 6-10 p.c. The insectivores consume, almost without any exception, the nourishment given by the biotop. From the herbivores of the woods, those belonging to the columbine class and the carnivores obtain the great part of their nourishment from territories outside the wood. Not to speak about the crows of mixed nourishment. In this way the woods are invaded - mainly from the agricultural areas - by a great quantity of energy; these woods are, therefore, to be considered - from nourishmen-biological point of view - as open biotops.

On the other hand, the meadows and pastures can be considered as closed areas because the avifauna living there can obtain on the spot the nourishment of necessary amount and kind.

Their role in protecting the avifauna biologically and in conserving the biological balance is, therefore, a double one: partly they serve the protection of the nesting biotop - main biotop - partly have an influence on the traffic of materials in the nourishment biotop e.g., agricultural areas, pastures. The question whether this effect is of negative or of positive value, depends upon more factors. At any rate, we may establish unequivocally that the few carnivores that consume first of all rural rodents and the kinds of doves and finches eating weed-seeds are useful for the adjacent agricultural areas. The *Corvus frugilegus* L. of mixed nourishment, if breeding too rapidly, may be noxious to its surroundings. I will still return separately to this problem.

Studying the avifauna of the different biotops and comparing it with L. Horváth's work "Communities of breeding birds in Hungary", I had to establish that these communities do not present themselves as purely and typically as indicated in the monograph quoted.

I have discovered here different modifications of the communities indicated there. In the woods of borrow pits of the inundation areas, in the willow-plantations, the native poplars and acacia woods the collectivity *Locustella fluviatilis* can be discovered but not typically and in a similar quantitative and qualitative composition but in a form adapted to the peculiarities of the biotop. The differences are induced by the presence or absence of some species, resp. by the changes in the dominance relations of the present species. It is extremely difficult to determine the type of a nesting community if it can be observed only in fragments. This is the case, in my opinion, e.g. in the ash-woods and the noble poplares planted where the fragments of theabove community seem to be present. Here and there the situation was complicated because there could be discovered three adjacent communities of decreased numbers of species but being confinable from each other.

An example for that was an ash-wood where I have discovered, anart from the *Locustella fluvialis* community already mentioned and being in fragments, the communities of *Milvus migrans* - heron settlement - and *Corvus frugilegus*, as well.

I could observe in the orchards the adaptation of the *Carduelis cannabina* community that is convenient to the local conditions, getting more vivid and richer in species settled in from the adjacent inundation woods.

In the course of analysing the meadows and pastures, I have established that both biotop types belong to the sphere of interest of the nesting community *Corvus cornix*. At the same time, however, owing to the physiognomical difference of biotops, we find two varieties of the communities. While in the meadows with trees and shrubs the members of community hatching on trees, shrubs are present, in the treeless pastures we can observe the absolute dominance of the terricolous species.

I have found in more biotop types a closed, independent community, the ensemble *Corvus frugilegus*. As in the area investigated the number of crow settlements and that of pairs nesting there is considerable, I consider as necessary to make known in details the results obtained. /Cf. Table 1/.

Table 1. The crow colonies found in the area investigated and their nesting data

biotop	numbers of colonies	crow nests	daw nests
Borrow-wood	IV	325	10
"	V	351	-
"	VI	180	-
Willow-plantation	VII	230	-
Noble poplar-wood	VIII	177	-
"	IX	219	-
Ash-wood	I	282	15
"	II	1131	-
Native poplar-wood	III	648	-
"	X	423	-
Total:		3966	25

The number of nesting crows is, therefore, rather considerable. So much that they induce here and there considerable damages in the yellow corn crops even to-day. An example for that is the case of the farmers' agricultural co-operative in Tiszaszőllős where the farm of a comparatively small area had to employ thirty men for motion away the crow. At any rate, the crows present themselves as harmful only in the time of feeding their young ones - what is simultaneous with sowing the corn and its sprouting - but only where they cannot find in the neighbourhood any meadow or pasture

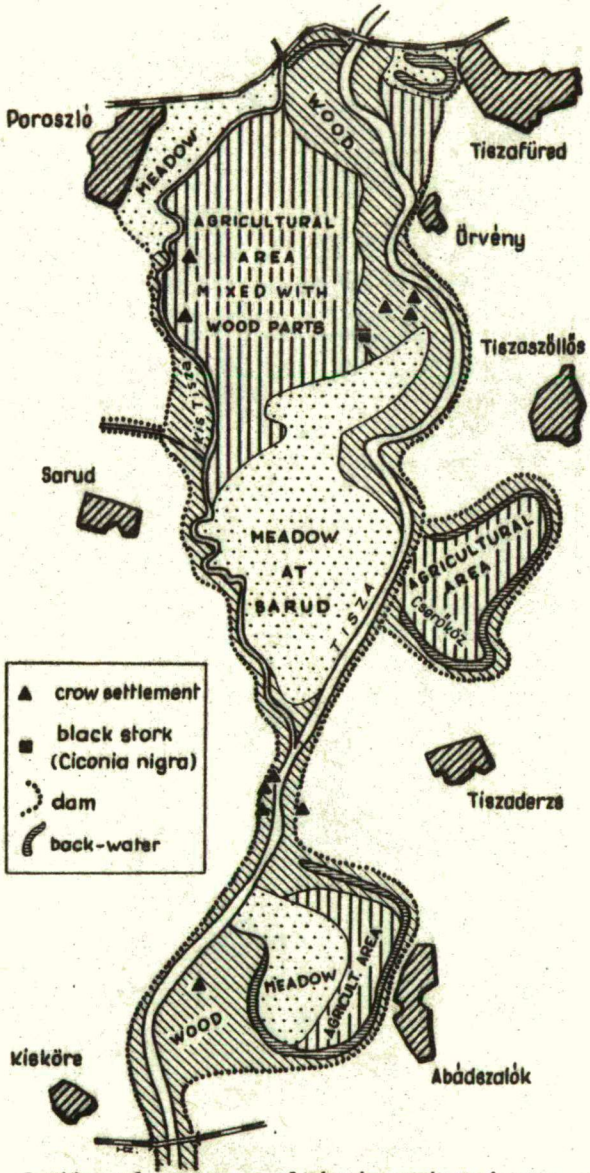

Fig. 1. Outline of structure of the investigated area, with heron and crow colonies, as well as the nesting sites of the black stork /*Ciconia nigra* L./

where they can obtain the food necessary for them. This problem will be graver in the future. As all the woods in the inundation areas are being cleared the crows connot help invading the woods lying outside the inundation dams and concentrating there. It may be supposed with reason that in this case they will touch more keenly the economy of the adjacent agricultural areas. Even if we cannot suggest a concrete and decisive solution for the time being, we ought to look for an economical and humane way for solving the crow problem that is to be expected.

The investigation and identification of the nesting communities called the attention to that the good and serviceable system prepared by L. Horváth would be worth while being developed, disintegrating the single nesting communities into sub-types, and even completing them possibly with new ones.

Summary

Summing up what was said above, we may establish that the investigated huge inundation area is composed of the mosaic of different biotops of various characters. The local observations and analysis did not cover the few mort-lakes of small extent or the agricultural areas, because of the causes made known above. A further cause of that was that these territories do not play any considerable role in forming the picture of the inundation area.

The dominance of the xerophilous elements opposite to the hydrophilous ones, even in an inundation area, is characteristic of the composition of the avifauna. This dominance is expressed both in the number of species and in that of the individual specimens.

It refers to the considerable extent of woods in the inundation area that the great number of species are arbicolous, hatching on the foliage level. The old age of woods can be concluded from the high percentage of the hollow--dwellers.

As to the distribution of the avifauna according to nourishment, I have observed the dominance of insectivores. The groun is represented mainly by the warblers with a great number of species and specimens. And while here are the herbivores outdone, after the evaluation of the weight dominance they get a considerable advantage. Both grouns are economically important and extremely useful.

Here I refer to that the woods are open biotops, and the energy pouring in the form of food from the adjacent, mainly agricultural areas is composed first of all of agricultural parasites and weedseeds. I am fully aware that the picture given about this field is not complete, however I have tried to give it. This can partly be understood because I should need several years work for giving a complete picture. In this area, however, where everything is doomed to perish I had no time for that. Our task was rather to measure and to immortalize as much and as exactly as possible from the life of the area for our own use and for teaching the generations yet to come.

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Ecological and coenological investigations of Orthoptera in the environs of Poroszló

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Abstract

As a continuation of an investigation series before /G a u s z 1966, G a l l é - G a u s z 1968, G a u s z 1969/, we carried out the collection series published below, from July 26th until August 5th 1969. These investigations contain the results of collections in the Middle-Tisza region at 12 stations of 5 biotopes. The causes of different distribution of *Orthoptera* are given as a function of various ecological conditions.

Methods

From the relative methods used at quantitative collectings I have applied the collecting technique used by G a l l é - G a u s z /1968/. In case of the *Acrididae* family, I have applied 4 x 100 grass-net strokes in every biotop, resp. collecting; and in the case of the *Tettigoniidae* family I have used the method of singling. At the *Angelico-Cirsietum oleracei* Tx. 37 population I applied "time-collection" for an hour. The methods mentioned above were repeated three times in every area during the 11-day period available for me. In the single biotops, there was given also the discovered amount of nymphs and, if possible, they were also determined on species or genus level. The ecological type and the distribution of the fauna according to spectrum are given on the basis of H a r z's work /1957/.

Characterization of biotops and coenoses

As the ecological collectings of *Orthoptera* are generally determined in respect of plant association, I am applying that method in this paper, as well. Concerning the plant associations I accepted S o ó's /1964/ nomenclature. The structural conditions of the vegetation and the variation of the single abiotic factors, first of all the microclimate are, however, often more important than the exact nomination of the association /C l a r k 1948/. I indicate, therefore, these data, as well. On the basis of a classification like that, the following associations can be distinguished:

1. *Angelico-Cirsietum oleracei* Tx. 37. association with high stalks in the inundation area, containing *Rubus caesius* L. in large amount. Height of vegetation is 50-60 cm, cover 100 p.c., three-level association /moss, grass, shrub/.

2. Meadow in the inundation area:

a. Grass-land of large extent, with *Alopecuretum pratensis cynodontetosum* B o d r o g k ö z y 62. association, immediately after mowing. Height of vegetation is 5-10 cm, cover 100 p.c. There are shrubs /*Prunus spinosa* L. in smaller spots.

b. Grass-land of lower site, *Caricetum vulpinae* S o ó 27. association. Height of vegetation is 5-10-20 cm, here and there becoming weedy; cover is 90-95 p.c., in the immediate vicinity of the weed associations along the way.

c. Grass-land of lower site, rather wet subsoil. Height of vegetation is 20-30-40 /-50/ cm, cover 90-95 p.c., in the vicinity of *Scirpo-Phragmitetum austro-orientale* S o ó 57. association.

d. Grass-land with high sedge, *Caricaetum acutiformis-ripariae* S o ó /27/ 30 association, height being 30-40-60 /-80/ cm, cover 95-100 p.c. Strongly shaded, not mown for long.

e. Reedy part in the inundation area, *Scirpo-Phragmitetum* association, with wet sub-soil. Immediately after mowing, the height of vegetation is 5-10 cm, cover 80 p.c.

3. The under growth of the inundation wood is *Salicaetum albae-fragilis* I s s l e r 26. First of all *Rubus caesius* L. stand, strongly shaded. Height of vegetation is 40-50 cm, cover 80 p.c.

4. Inundation pasture, *Glycyrrhizetum echinatae* /K e r n. 1868/ S o ó 40 association, height of vegetation is 3-5-10 cm, cover 80-90 p.c., the biotop is disturbed by the standing pasturing.

5. Dam-side.

a. The lower half part of the inundation-side of dam is the ecotone of the *Rubus caesius* L. stand, strongly enough shaded. It is a variety, becoming strongly weedy, of the *Alopecuretum pratensis festucetosum pseudovinae* S o ó 57 association. In the phase before mowing the height of vegetation is 15-25-40 cm, cover 100 p.c.

b. On the upper part of the inundation-side of dam the association and Eastern exposition agree with the previous collecting station, but they are less shaded.

c. The upper part of the protected inundation-side of dam, the association conditions are agreeing with the former one. Western exposition.

d. In the lower part of the protected inundation-side of dam also the *Consolido-Stachyetum annuae* /S o ó 47/ T i m á r 57 weed-association takes part in developing the vegetation. The height conditions are similar, as well; cover is 90-95 p.c. It is in immediate vicinity of the plough-lands, the shrub stand is smaller.

Orthoptera fauna of biotops

1. Association with high stalks in the inundation area. The population is of low specimen number, as a result of the high vegetation shaded strongly. It contains mostly phytocolous species /Table 1/.

Species	Ec. type	Area	No.	D p.c.
Leptophyes albovittata Koll.	Hyg.	Cent. Eu.	3	13,2
Conocephalus fuscus Fabr.	Hyg.	Palearc.	1	4,34
Conocephalus dorsalis Latr.	Hyg.	Eu.-Sib.	3	13,02
Homorocoryphus nitidulus Scop.	Hyg.	South Eu.	2	8,68
Roeseliana roeselii Hgb.	Hyg.	Eu.-Sib.	3	13,02
Chorthippus albomarginatus Deg.	Hyg.	Palearc.	+	-
Chorthippus dorsatus Zett.	Hyg.	Palearc.	6	26,32
Chorthippus longicornis Latr.	Mes.	Eu.-Sib.	2	8,68
Ch. nymph	Hyg.	-	2	8,68
Euchorthippus declivus Bris.	Mes.	Cent.-Eu.	1	4,34

2. Meadow in the inundation area

a. Grass-land. Strongly hygrophilous fauna. Besides the *Ch. albomarginatus* D e g., however, I have discovered only one specimen of *Parapleurus alliaceus* G e r m., while *Mecostethus grossus* L. is almost entirely missing, opposite to G a u s z's /1969/ collectings carried out in a similar biotop. *Aiolopus thalassinus* F a b r. is no characteristic species of the biotop /Table 2/.

Species	Ec. type	Area	No.	D p.c.
Homorocoryphus nitidulus Scop.	Hyg.	South Eu.	1	1,22
Tetrix subulata L.	Hyg.	Palearc.	8	9,76
Tetrix tenuicornis Sahlb.	Hyg.	Palearc.	3	3,66
Aiolopus thalassinus Germ.	Xer.	Med.	2	2,44
Mecostethus grossus L.	Hyg.	Eu.-Sib.	+	
Parapleurus alliaceus Germ.	Hyg.	Eu.-Sib.	1	1,22
Chorthippus albomarginatus Deg.	Hyg.	Palearc.	56	68,28
Chorthippus dorsatus Zett.	Hyg.	Palearc.	3	3,66
Chorthippus longicornis Latr.	Mes.	Eu.-Sib.	2	2,44
Chorthippus nymph	Hyg.	-	6	7,32

b. Lower sedge stand in the inundation area. *Orthoptera* population of lower specimen number but rich in species, influenced probably also by the weed population along the adjacent way. The occurence of the alone male specimen of *Dociostaurus maroccanus* T h u n b g. is remarkable.

Species	Ec. type	Area	No.	D p.c.
Conocephalus fuscus Koll.	Hyg.	Palearc.	3	13,02
Homorocoryphus nitidulus Scop.	Hyg.	South Eu.	3	13,02
Roeseliana roeselii Hgb.	Hyg.	Eu.-Sib.	2	8,68
Glyptobothrus brunneus Thunbg.	Xer.	Palearc.	4	17,36
Chorthippus albomarginatus Deg.	Hyg.	Palearc.	7	30,56
Chorthippus dorsatus Zett.	Hyg.	Palearc.	1	4,34
Chorthippus longicornis Latr.	Mes.	Eu.-Sib.	2	8,68
Chorthippus nymph	Hyg.	-	1	4,34
Dociostaurus maroccanus Thunbg.	Xer.	South Eu.	+	

c. Meadow with high sedge in the inundation area. Mostly with strongly hygrophilous species, except a few specimens of the *Omocestus ventralis* Zett. with broad ecological tolerance-limit. *Chrysochraon dispar* G e r m. that is rather rare in the Hungarian Plain, is faunistically remarkable.

Species	Ec. type.	Area	No.	D p.c.
Chrysochraon dispar Germ.	Hyg.	Eu.-Sib.	+	
Omocestus ventralis Zett.	Xer.	Palearc.	3	7,50
Chorthippus albomarginatus Deg.	Hyg.	Palearc.	24	60,00
Chorthippus dorsatus Zett.	Hyg.	Palearc.	3	7,50
Chorthippus longicornis Latr.	Mes.	Eu.-Sib.	4	10,00
Chorthippus nymph	Hyg.	-	2	5,00
Euchorthippus declivus Bris.	Mes.	Cent. Eu.	4	10,00

d. Grass-land with high sedge. Compared with the former ones, it is a less troubled population. The dominance of the *Conocephalus* species is much higher while the other species compared with the former biotops are indenti-cal ones.

Species	Ec. type	Area	No.	D p.c.
Conocephalus fuscus Fabr.	Hyg.	Palearc.	18	30,61
Conocephalus dorsalis Latr.	Hyg.	Eu.-Sib.	9	15,31
Roeseliana roeselii Hgb.	Hyg.	Eu.-Sib.	1	1,69
Tetrix subulata L.	Hyg.	Palearc.	4	6,76
Tetrix tenuicornis Sahlb.	Hyg.	Palearc.	5	8,45
Mecostethus grossus L.	Hyg.	Eu.-Sib.	1	1,69
Parapleurus alliaceus Germ.	Hyg.	Eu.-Sib.	+	
Chorthippus albomarginatus Deg.	Hyg.	Palearc.	8	13,52
Chorthippus longicornis Latr.	Mes.	Eu.-Sib.	11	18,59
Euchorthippus declivus Bris.	Mes.	Cent. Eu.	2	3,38

e. Cut reeds in the inundation area. *Orthoptera* population with extremely low specimen number, of exclusively hygrophilous species, without nymphs.

Species	Ec. type	Area	No.	D	n.c.
Phaneroptera falcata Poda.	Mes.	Eu.-Sib.	1		6,24
Conocephalus fuscus Fabr.	Hyg.	Palearc.	+		
Tetrix tenuicornis Sahlb.	Hyg.	Palearc.	2		12,48
Chorthippus dorsatus Zett.	Hyg.	Palearc.	2		12,48
Chorthippus longicornis Latr.	Mes.	Eu.-Sib.	11		68,80

3. Undergrowth of the wood in the inundation area. From the species of the population only the *Pholidoptera griseoaptera* D e g. is characteristic of the population. *Meconema thalassinum* D e g. derives supposedly from the foliage level. It is proved also by the absence of nymphs that here may be formed only a temporary *Orthoptera* population.

Species	Ec. type	Area	No.	D	n.c.
Phanoptera falcata Poda	Mes.	Eu.-Sib.	6		39,96
Meconema thalassinum Deg.	Hyg.	Eu.-Sib.	+		
Pholidoptera griseoaptera Deg.	Hyg.	Eu.	1		6,66
Tetrix tenuicornis Sahlb.	Hyg.	Palearc.	+		
Chorthippus albomarginatus Deg.	Hyg.	Palearc.	2		13,32
Chorthippus longicornis Latr.	Mes.	Eu.-Sib.	5		33,40

4. Pasture in the inundation area. In spite of the comparatively considerable differences in vegetation, it is a *Saltatoria* population that is very similar to the former ones, having exclusively hygrophilous species despite the increased solar radiation.

Species	Ec. type	Area	No.	D	n.c.
Roeseliana roeselii Hgb.	Hyg.	Eu.-Sib.	2		4,08
Tetrix subulata L.	Hyg.	Palearc.	1		2,04
Chorthippus albomarginatus Deg.	Hyg.	Palearc.	5		10,20
Chorthippus dorsatus Zett.	Hyg.	Palearc.	10		20,40
Chorthippus longicornis Latr.	Mes.	Eu.-Sib.	25		51,04
Chorthippus nymph	Hyg.	-	6		12,24

5. Dam-side.

a. Lower half part of the inundation-side of dam.

It is a *Rubus caesius* L. ecotone and a *Saltatoria* population with lower specimen number if compared with the coenoses on the dam-side because of being more strongly shaded. The mesophilous species have an increased dominance.

Species	Ec. type	Area	No.	D	n.c.
Homorocoryphus nitidulus Scop.	Hyg.	South Eu.	4		7,68
Roeseliana roeselii Hgb.	Hyg.	Eu.-Sib.	1		1,92
Tetrix tenuicornis Sahlb.	Hyg.	Palearc.	2		3,84
Omocestus haemorrhoidalis Charp.	Mes.	Eu.-Sib.	2		3,84
Omocestus nymph	Mes.	-	2		3,84
Chorthippus albomarginatus Deg.	Hyg.	Palearc.	3		5,76
Chorthippus dorsatus Zett.	Hyg.	Palearc.	1		1,92
Chorthippus longicornis Latr.	Mes.	Eu.-Sib.	25		48,16
Chorthippus nymph	Hyg.	-	4		7,68
Euchorthippus declivus Bris.	Mes-	Cent. Eu.	8		15,36

b. Upper part of the inundation-side of dam. Owing to the more expressed effect of the favourable Eastern exposition, the specimen density of *Saltatoria* has increased. The hygrophilous *Chorthippus* species are rare enough, and it is proved by the presence of *Glyptobothrus brunneus* T h u n b g. that the conditions are more favourable for the more xerophilous species. *Euchorthippus declivus* B r i s. is super-dominant.

Species	Ec. type	Area	No.	D p.c.
Leptophyes albovittata Koll.	Hyg.	Cent. Eu.	2	1,48
Homorocoryphus nitidulus Scop.	Hyg.	South.Eu.	3	2,22
Platycleis affinis Fieb.	Mes.	Ponto-Med.	+	
Tessalana vittata Charp.	Xer.	South Eu.	2	1,48
Tetrix tenuicornis Sahlb.	Hyg.	Palearc.	+	
Parapleurus alliaceus Germ.	Hyg.	Eu.-Sib.	2	1,48
Glyptobothrus brunneus Thunbg.	Xer.	Palearc.	10	7,44
Omocestus nymph	Mes.	-	8	5,92
Chorthippus albomarginatus Deg.	Hyg.	Palearc.	2	1,48
Chorthippus longicornis Latr.	Mes.	Eu.-Sib.	4	2,96
Euchorthippus declivus Bris.	Mes.	Cent.Eu.	101	75,54

c. Upper part of the protected inundation-side of dam. The population conditions are more and less similar. The Western exposition is favourable to the hygrophilous-mesophilous species. There are comparatively many nymphs.

Species	Ec. type	Area	No.	D p.c.
Conocephalus dorsalis Latr.	Hyg.	Eu.-Sib.	3	1,88
Tessalana vittata Charp.	Xer.	South Eu.	7	4,37
Stenobothrus nymph.	-	-	+	
Omocestus nymph	Mes.	-	20	12,50
Glyptobothrus brunneus Thunbg.	Xer.	Palearc.	11	6,88
Chorthippus longicornis Latr.	Mes.	Eu.-Sib.	23	14,37
Chorthippus nymph	Hyg.	-	14	10,00
Euchorthippus declivus Bris.	Mes.	Cent. Eu.	80	50,00

d. Lower part of the protected inundation-side of dam. The high specimen-density of *Saltatoria* is caused by the favourable exposition conditions and probably by other advantageous microclimatic factors. We have found a great number of specimens of the grasshopper species *Tessalana vittata* C h a r p. that is frequent in the district of the Middle Tisza, taking here the place of *Roeseliana roeselii* H g b. The fauna is shifted in a greater degree in mesophilous-xerophilous direction.

Species	Ec. type	Area	No.	D p.c.
Tessalana vittata Charp.	Xer.	South Eu.	10	6,17
Roeseliana roeselii Hgb.	Hyg.	Eu.-Sib.	2	1,22
Omocestus haemorrhoidalis Charp.	Mes.	Eu.-Sib.	7	4,27
Omocestus nymph	Mes.	-	12	7,32
Chorthippus albomarginatus Deg.	Hyg.	Palearc.	14	8,54
Chorthippus longicornis Latr.	Mes.	Eu.-Sib.	25	15,25
Chorthippus dorsatus Zett.	Hyg.	Palearc.	19	11.59
Chorthippus nymph	Hyg.	-	6	3,66
Euchorthippus declivus Bris.	Mes.	Cent.Eu.	67	41,98

Ecological evaluation of the *Saltatoria* populations in the areas investigated

From the areas investigated, in the course of the operations, I have collected 2435 specimens of 24 species. These are generally common from faunistical point of view in the inundation biotops of the Great Hungarian Plain. Perhaps only the *Chrysochraon dispar* G e r m. that is characteristic of the marshy meadows, and the semiarid species *Doclostaurus maroccanus* T h u n b g. with a broad ecological tolerance can be classified into the rarer species.

It is important to emphasize that we have found by and large similar *Saltatoria* populations even in the comparatively different biotops, and the discovered differences were expressed rather in the number of specimens. This is remarkable as compared with G a u s z's /1969/ material at Kisköre where in the marshy meadows of the inundation area first of all the *Mecostethus-Parapleurus Saltatoria* population group mentioned by N a g y /1949/, could be demonstrated, while here are these species insignificant. It would be necessary, of course, to take into consideration the identical aspects of the same year as the hatching percentage of eggs, and thus the size and structure of populations, depend upon the meteorogical changes /R i c h a r d s - W a l o f f 1954/.

Under the conditions of the inundation areas, if in the period of the spring inundation the eggs laid in autumn are still in the state of diapausa, there takes place no particular damage /B o d e n h e i m e r - S h u l o v 1951/. As in case of the single species the time of ovinosition and, therefore, also the state of diapausa can strongly change, the composition of the grasshopper populations may be changed by the inundations from year to year.

On the basis of the collectings carried out concerning all the biotops of the collecting station, we had better to represent the distribution of the single species according to the ecological, resp. biogeographic spectra. In connection with these, the effects of the microclimatic influences can be compared in the collectings from the dam-sides, and those of the height-differences of vegetation in those from the meadows in the inundation area, on the basis of the two formerly characteristics.

Ecological demand /p.c./		Biogeographic spectrum /p.c./	
Hygrophilous	38,84	Central-European	31,17
Mesophilous	55,05	Palearctic	36,10
Xerophilous	6,11	Euro-Siberian	28,36
		South-European	4,00
		Mediterranean	0,25
		European	0,12

Changes in specimen number, ecological demand, and biogeographic spectrum along the biotops on the dam-side.

	Specimen number Total sp. n.c.	Ecological demand Hygrophilous	Mesophilous	Xerophilous
1. Lower part in the inundation area	10,19	28,80	71,20	-
2. Upper part in the inundation area	26,70	6,66	84,42	8,92
3. Upper part in the protected area	31,36	11,88	76,87	11,25
4. Lower part in the protected area	31,75	25,01	68,82	6,17

biogeographic spectrum:

	Euro-Sib.	Palearc.	Central Eu.	South-Eu.
1. Lower part in the inundation area	61,44	15,92	15,36	7,68
2. Upper part in the inundation area	10,36	8,92	77,02	3,70
3. Upper part in the protected area	33,75	11,98	50,00	4,37
4. Lower part in the protected area	29,72	22,13	41,98	6,17

Changes in specimen number. Ecological demand, and biogeographic spectrum in the meadows of the inundation area

Height of vegetation	Specimen number	Ecological demand Hygrophilous	Mesophilous	Xerophilous
1. 5-10 cm	40,22	95,12	2,44	2,44
2. 5-10-20 cm	11,27	73,96	8,68	17,36
3. 20-30-40 cm	19,60	72,50	20,00	7,50
4. 30-40-60 cm	28,91	78,03	21,97	-

biogeographic spectrum

	Eu.-Sib.	Palearc.	Central Eu.	South-Eu.	Mediterranean
1. 5-10 cm	6,98	89,36	-	1,22	2,44
2. 5-10-20 cm	19,36	67,62	-	13,02	-
3. 20-30-40 cm	12,40	77,60	10,00	-	-
4. 30-40-60 cm	37,18	59,34	3,38	-	-

The comparison of these data may cause difficulties because the accentuation of a single factor /at the biotops on dam-sides the exposition or the vertical position, at the meadows in the inundation area the height of vegetation/ cannot give an exact explanation. At the biotops on the dam-sides it can be well demonstrated that the xerophilous species avoid the ecotone of the *Rubus caesius* L. stand, and here is the specimendensity of *Saltatoria* generally low. It can also be demonstrated that the Western exposition is more favourable to the hygrophilous species. In the biogeographic spectrum, the percentage of the occurrence of Euro-Siberian species correspondingly

higher, if we leave out of consideration the ecotone of *Rubus caesius* L. which is shaded.

We have difficulty at the meadows in the inundation area, as well, if we wanted to prove the generally known unfavourable role of the growing height of vegetation /Rubtzov 1932, Uvarov 1928/ as here also mowing and pasturing take place as disturbing factors. In this respect there is the least disturbed collecting station marked "4", where there took place neither mowing nor pasturing in the given period. In the collecting station "2", however, the moist soil and the vegetation that was strongly disturbed and became weedy are very unfavourable to the development of *Saltatoria* populations. Taking all these into consideration, we may establish that a high vegetation has an unfavourable effect on the *Orthoptera* population.

Summary

In the course of the ecological and faunistic of collections carried out in the environment of Poroszló, there could be demonstrated 24 species on the basis of 12 biotops, resp. collectings. There were remarkable from them: *Chrysochraon dispar* G e r m. and *Dociostaurus maroccanus* T h u n b g.

In the different biotops, the following *Saltatoria* populations could be established: 1. Undergrowth of the wood in the inundation area, *Phaneroptera falcata-Chorthippus longicornis* /1/; 2. Weed-association with high stalks: *Leptophyes albovittata-Conocephalus* /2/; Grass-land in the inundation area: *Chorthippus albomarginatus-Chorthippus longicornis* /3a,b,c,d, 4/; 4. Dam-side: *Euchorthippus declivus-Chorthippus longicornis* /5a,b,c,d/. We can, of course, find larger or smaller transitions, first of all a lesser fluctuation in the composition of species.

In the development of the *Saltatoria* populations in the whole area, apart from the conditions of vegetation, a major role may be played also by certain ecological factors /exposition, height of vegetation, the vegetation being shaded, disturbed/ and the effect of them can be proved well. On the basis of the collectings we may establish that the *Orthoptera* fauna of the Middle-Tisza district is particular and can be separated from other biotops along the Tisza. It is, anyway, to be mentioned that a collecting carried out for a definite time, like this, cannot give at all the true picture of the fauna.

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Faunistical and ecological observations on the Orthoptera fauna of the Hungarian Plain

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Abstract

The author is publishing some data in the framework of his systematic investigations performed since 1963 concerning *Orthoptera* fauna / G a u s z 1966, G a l l é, Jr.- G a u s z 1968, G a u s z 1969/, about the faunistical and coenological picture of the Tisza basin, belonging to the Crisicum, with regard to the *Orthoptera* fauna. Apart from detailed collections, anyway, he has carried out a great number of minor investigations of similar nature, as well. In this work his unpublished faunistical, resp. coenological data are analysed. It is to be mentioned that a part of data do not refer immediately to the Tisza basin. But the fauna of the sandy and sodic areas that are fundamentally characteristic of the Great Hungarian Plain is a special one; therefore, it is advisable to compare it with the biotops of inundation areas. The collecting stations and dates in this work are as follows: Tiszakarád 1964, VII; Vesszős 1966, VIII; Porgány 1966, IX; Tiszakürt 1966, VIII; and from the biotops lying not in the Tisza basin: Ásotthalom 1969, IX; Fehértó 1964, VIII.

Methods

In the collections carried out till 1965, the collection of the fauna took place generally by means of sweeping net applied for some time, similarly to G a u s e ' s /1930/ procedure. Later on, at the collections I have substituted for that a definite number of net strokes and singlings combined with this, according to D i v e r and D i v e r ' s /1933/ method. In some biotops covered with low vegetation, however, I have got on with applying a so-called "time-collection". This raises, of course, difficulties in comparing the collectings carried out with two different methods; although after collecting in the homogeneous grass substance with both methods I have got the result that a grass sweeping performed for an hour is quantitatively analogous with 400 sweeping-net strokes /net emptied after five strokes/. The *Tettigonlidae* species were, at any rate, to be singled in every case. At the collecting stations of Porgány and Vesszős, every collectings gives the avarage of collecting three times with 5-day intervals, and it is better not to take into consideration, only to indicate at the calculation of dominance the species that occur only in one collecting.

The coenological evaluation of biotops

1. T i s z a k a r á d . The wood of the inundation area belongs to the *Salicetum albae fragilis* I s s l e r association. The *Carpinus* and *Alnus* woodlands of the Northern Tisza regions are missing, the *Juglans* woodlands, however, are frequent. Collecting in two biotops.

a. *Alopecuretum pratensis caricetosum melanostachyae* Soó /57/ association. Cover 100 per cent, vegetation-height changes between broad limits, 5-10-15-/-30-40/cm. The biotop of ecotone type has an extremely high number of species and specimens. The *Saltatoria* populations / U v a r o v 1957, K e y 1950/ are generally favourably influenced by the presence of mosaic vegetation, as observed also here. Faunistically there are remarkable the *St.lineatus* P a n z., demonstrated from the Hungarian Plain first by N a g y /1953/, and the *Chrysochraon dispar* G e r., a typical marshland species. The dominant species of the population are hygrophylous-mesophylous elements.

Ec. type	Area	Species	No.	D p.c.
Mes.	Eu.-Sib.	*Phaneroptera falcata*	3	3,1
Hyp.	Cent.-Eu.	*Leptophyes albovittata*	13	13,5
Hyg.	Palearc.	*Conocephalus fuscus*	4	4,2
Mes.	Palearc.	*Tettigonia viridissima*	2	2,1
Xer.	Eu.-Sib.	*Bicolorana bicolor*	1	1,1 /1
Xer.	Palearc.	*Calliptamus italicus*	8	8,3
Xer.	Palearc.	*Oedipoda coerulescens*	6	6,2
Hyg.	Eu.-Sib.	*Chrysochraon dispar*	2	2,1
Mes.	East.Eu.	*Stenobothrus crassipes*	12	12,5
Hyg.	Eu.-Sib.	*Stenobothrus lineatus*	2	2,1
Mes.	Eu.-Sib.	*Omocestus haemorrhoidalis*	10	10,4
Hyg.	Palearc.	*Chorthippus albomarginatus*	22	22,9
Hyg.	Palearc.	*Chorthippus dorsatus*	6	6,2

b. *Consolido orientali - Stachyetum annuae* /S o ó 47/ T i m á r 57 association is a weed association between the dam and plough-land. The vegetation is high, here and there as high as 60 cm and the cover is 95 p.c. The quantitative conditions of *Orthoptera* are influenced unfavourably by that, as alleged by C l a r k /1967/, as well. The occurrence of *Pholidoptera aptera aptera* F a b r. is interesting as it is a species of mountain character and, supposedly, the Bodrog basin has had a role in its presence here.

Ec. type	Area	Species	No.	D p.c.
Mes.	Eu.-Sib.	*Phaneroptera falcata*	5	6,1
Hyg.	Centr.Eu.	*Leptophyes albovittata*	9	11,0
Hyg.	Palearc.	*Conocephalus fuscus*	6	7,3
Hyg.	Eu.-Sib.	*Roeseliana roeselii*	3	3,7
Xer.	Palearc.	*Oedipoda coerulescens*	1	1,2
Mes.	Eu.-Sib.	*Omocestus haemorrhoidalis*	15	18,3
Hyg.	Palearc.	*Chorthippus albomarginatus*	29	35,4
Hyg.	Palearc.	*Chorthippus dorsatus*	14	17,1

2. T i s z a k ü r t . Collecting was only in a single biotop, on a dry damside with vegetation of moderate height. *Cynodonti-Poëtum angustifoliae* /R a p a i c s 26/ S o ó 57 association, height of vegetation 5-7-10 /-20/ cm, cover 90-95 p.c. Even among the species of the association there are several xerophilous components as, e.g., the *Acrida hungarica* H e r b s t , *Omocestus ventralis* Z e t t., *Aiolopus thalassinus* F a b r. and the psammophilous *Stenobothrus nigromaculatus* H. - S.

From the considerable components of the population, *Pezotettix giornae* R o s s i played a considerable role in the biotops of the Lower-Tisza region between 1964 and 1966 but in the collectings of 1969 its number is already moderate. For explaining this multiplication and the following regression, we had to know more the fluctuation of the single climatic factors in the given aspect. Periodic fluctuations like these can be induced by inundations and the amount of precipitation, by increasing the mortality of the specimens in the state after the diapause. These effects concern, however, not only single species but the entire insect population of the given area.

Ec. type	Area	Species	No.	D	p.c.
Hyg.	Palearc.	*Tetrix subulata*	6		6,1
Hyg.	Palearc.	*Tetrix tenuicornis*	5		5,1
Xer.	Med.	*Pezotettix giornae*	16		16,3
Xer.	Med.	*Aiolopus thalassinus*	1		1,0
Xer.	Cent.Eu.	*Acrida hungarica*	2		2,0
Mes.	East.Eu.	*Stenobothrus crassipes*	7		7,1
Xer.	Ponto-Med.	*Stenobothrus nigromaculatus*	3		3,1
Xer.	Palearc.	*Omocestus ventralis*	3		3,1
Mes.	Eu.-Sib.	*Omocestus haemorrhoidalis*	9		9,2
Hyg.	Palearc.	*Chorthippus dorsatus*	18		18,4
Mes.	Eu.-Sib.	*Chorthippus longicornis*	4		4,1
Mes.	Cent.-Eu.	*Euchorthippus declivus*	24		24,5

3. V e s s z ő s . In the collectings carried out vertically in the typical inundation biotop at the right bank of the Tisza, along the dam-side, I have delimited artificially six collecting areas. Although the single collections cannot be dealt with as independent biotops, nevertheless some differences can be demonstrated.

a. It is the ecotone between the *Salicetum albaefragilis* I s s l e r 26. in the inundation area and *Alopecuretum pratensis ranunculetosum acris* S o ó 57 on the dam-side. The *Orthoptera* fauna is insignificant.

Ec. type	Area	Species	No.	D	p.c.
Hyg.	Palearc.	*Conocephalus fuscus*	1		25,0
Hyg.	Ponto-Med.	*Pteronemobius heydeni*	2		50,0
Hyg.	Palearc.	*Chorthippus albomarginatus*	1		25,0

b. The vegetation on the dam-side of inundation area is a mixture of the association of *Alopecuretum pratensis ranunculetosum acris* and *Alopecuretum pratensis normale*, B o d r o g k ö z y 62.
The height of vegetation is 3-5-10 /-15-30/cm, cover 90-95 p.c. It is the area mostly exposed to spring inundations. As a result of that, and of the S.E.-exposition, the vegetation is rarer and that is expressed in the *Orthoptera* fauna, as well, by the decrease of the dominance of the hygrophilous-*Chorthippus* species. *Glyptobothrus biguttulus* L. appears as a considerable population component, as well.

Ec.type.	Area	Species	No.	D p.c.
Xer.	Ponto-Med.	*Acheta desertus*	1	1,4
Hyg.	Palearc.	*Tetrix subulata*	13	18,9
Xer.	Med.	*Pezotettix giornae*	12	17,4
Xer.	Cent. Eu.	*Acrida hungarica*	1	1,4
Mes.	Eu.-Sib.	*Omocestus haemorrhoidalis*	15	21,7
Xer.	Palearc.	*Omocestus ventralis*	2	2,9
Xer.	Palearc.	*Glyptobothrus biguttulus*	9	13,1
Hyg.	Palearc.	*Chorthippus albomarginatus*	4	5,8
Hyg.	Palearc.	*Chorthippus dorsatus*	5	7,3
Mes.	Cent. Eu.	*Euchorthippus declivus*	7	10,1

c. *Schlerochloo-Polygonetum avicular* /G a m s 27/ S o ó 40. on the dam-top and in its immediate zone is not suitable to sustain a stable *Orthoptera* population. The height of vegetation is 3-5 cm, the cover interrupted, sometimes with plant-free plots. The species-combination is yet characteristic as it is a favourite dwelling place of a considerable part of geophilous species. The dominance of the mesophilous-hygrophilous elements is low.

Ec. type.	Area	Species	No.	D p.c.
Hyg.	Eu.-Sib.	*Roeseliana roeselii*	5	9,6
Xer.	Ponto-Med.	*Acheta desertus*	1	1,9
Xer.	Med.	*Pezotettix giornae*	22	41,7
Xer.	Palearc.	*Omocestus ventralis*	2	3,7
Mes.	Eu.-Sib.	*Omocestus haemorrhoidalis*	3	5,6
Xer.	South Eu.	*Omocestus petraeus*	1	1,9
Xer.	Palearc.	*Glyptopothrus brunneus*	6	11,3
Xer.	Palearc.	*Glyptobothrus biguttulus*	4	7,5
Hyg.	Palearc.	*Chorthippus albomarginatus*	3	5,6
Hyg.	Palearc.	*Chorthippus dorsatus*	3	5,6
Mes.	Cent.-Eu.	*Euchorthippus declivus*	5	5,6

d. *Alopecuretum pratensis cynodontetosum*. B o d r o g k ö z y , 62. Plant height is 5-10-15 /20-40/ cm, cover 100 p.c. The most typical orthopterous population along the Tisza, with high dominance of hygrophilous-mesophilous elementes. The decrease of the specimen number of *Pezotettix giornae* R o s s i is connected with the more limited amount of its nutrutuve, *Salvia pratensis*.

Ec.type	Area	Species	No.	D p.c.
Mes.	Eu.-Sib.	*Phaneroptera falcata*	1	1,6
Hyg.	Eu.-Sib.	*Roeseliana roeselii*	1	1,6
Hyg.	Palearc.	*Tetrix subulata*	2	3,3
Hyg.	Palearc.	*Tetrix tenuicornis*	1	1,6
Xer.	Med.	*Pezotettix giornae*	3	4,9
Xer.	Palearc.	*Omocestus ventralis*	1	1,6
Mes.	Eu.-Sib.	*Omocestus haemorrhoidalis*	5	8,3
Xer.	Palearc.	*Glyptobothrus biguttulus*	3	4,9
Hyg.	Palearc.	*Chorthippus albomarginatus*	9	14,6
Hyg.	Palearc.	*Chorthippus dorsatus*	27	44,6
Mes.	Cent.Eu.	*Euchorthippus declivus*	7	10,1

e. It is a population indentical with the former one, the height and frequency of vegetation decreases, but it is more shaded. The spots of rare vegetation on the place of haystacks form a special micro-biotop, first of all with *Euchorthippus declivus* Bris. population. The average frequency of specimens is low if compared with the former collectings.

Ec.type	Area	Species	No.	D p.c.
Hyg.	Eu.-Sib.	*Roeseliana roeselii*	2	3,4
Hyg.	Palearc.	*Tetrix subulata*	3	5,1
Xer.	Med.	*Pezotettix giornae*	25	41,5
Mes.	Eu.-Sib.	*Omocestus haemorrhoidalis*	2	3,4
Xer.	Palearc.	*Glyptobothrus biguttulus*	1	1,8
Hyg.	Palearc,	*Chorthippus albomarginatus*	12	19,9
Hyg.	Palearc.	*Chorthippus dorsatus*	7	11,6
Mes.	Cent.Eu.	*Euchorthippus declivus*	8	13,3

f. *Echinochloo-Chenopodietum polyspermi* / U b r i z s n y 49/ association on a ditch-side along a plough-land, vegetation height being 3-5-10-/-25/ cm, cover 90-95 p.c. Owing to a rather humid environment, the development of micro climate is favourable for hygrophylous species while the dominance of the mesophilous species is decreasing.

Ec.type	Area	Species	No.	D p.c.
Hyg.	South Eu.	*Homorocoryphus nitidulus*	3	6,8
Hyg.	Palearc.	*Tetrix subulata*	7	15,8
Hyg.	Palearc,	*Tetrix tenuicornis*	1	2,3
Xer.	Med.	*Pezotettix giornae*	21	47,7
Xer.	Palearc.	*Omocestus ventralis*	1	2,3
Mes.	Eu.-Sib.	*Omocestus haemorrhoidalis*	2	4,5
Xer.	Palearc.	*Glyptobothrus biguttulus*	+	
Hyg.	Palearc.	*Chorthippus albomarginatus*	5	11,4
Hyg.	Palearc.	*Chorthippus dorsatus*	+	
Mes.	Eu.-Sib.	*Chorthippus longicornis*	1	2,3
Mes.	Cent.Eu.	*Euchorthippus declivus*	3	6,9

4. P o r g á n y . At the left bank of Tisza, opposite to the former collecting station, a broader inundation area takes place. The higher part of dam-side lying on its ploughland side, is of deeper site, being eater-covered frequently even in July. The soil is of somewhat looser structure and richer in sand-fraction. Similarly to the former collecting station, we have distinguished here, too, sic stations and not biotops.

a. It is a rather humid biotop in the inundation area with *Alopecuretum pratensis poëtosum angustufoliae* /B g g l e r 59/ association, the height of vegetation being 3-5-10 cm, cover 100 p.c. The *Orthoptera* fauna is poor without forming a stable population.

Ec.type	Area	Species	No.	D. p.c.
Hyg.	South Eu.	*Homorocoryphus nitidulus*	1	3,7
Hyg.	Palearc.	*Tetrix subulata*	2	7,4
Xer.	Med.	*Pezotettix giornae*	14	51,6
Mes.	Eu.-Sib.	*Omocestus haemorrhoidalis*	8	29,6
Xer.	Palearc.	*Glyptobothrus biguttulus*	2	7,4
Hyg.	Palearc.	*Chorthippus dorsatus*	+	

b. It is a plant association conform to the former one, with similar height and cover conditions. On the sides of cross-dams leading into the inundation area different *Orthoptera* populations have developed as a result of the changing exposition. The role of xerophilous-mesophilous elements is increasing /*Euchorthippus declivus* B r i s ., *Glyphtobothrus biguttulos* L./

Ec.type	Area	Species	No.	D. p.c.
Hyg.	Palearc.	*Tetrix subulata*	1	2,2
Hyg.	Palearc.	*Tetrix tenuicornis*	1	2,2
Xer.	Med.	*Pezotettix giornae*	20	43,4
Xer.	Palearc.	*Omocestus ventralis*	4	8,7
Mes.	Eu.-Sib.	*Omocestus haemorrhoidalis*	12	28,1
Xer.	Palearc.	*Glyptobothrus biguttulus*	2	4,3
Hyg.	Palearc.	*Chorthippus dorsatus*	2	4,3
Mes.	Cent.Eu.	*Euchorthippus*	4	8,7

c. On the top of dam, similarly to the biotop at Vesszős, there is here, too, the *Schlerochloo-Polygonetum avicularis* association. The *Saltoria* population is formed mostly by mesophilous species. From the inundation biotops we could discover only here *Stenobothrus stigmaticus* Ramb.

Ec.type	Area	Species	No.	D p.c.
Hyg.	Palearc.	*Tetrix subulata*	1	2,7
Xer.	Med.	*Pezotettix giornae*	18	48,6
Xer.	Palearc.	*Oedipoda coerulescens*	1	2,7
Xer.	Eu.-Sib.	*Stenobothrus stigmaticus*	+	
Mes.	Eu.-Sib.	*Omocestus haemorrhoidalis*	13	35,1
Mes.	Cent.Eu.	*Euchorthippus declivus*	4	10,8

d. On the dam section lying on the side towards the protected inundation area, we have found, besides *Alopecuretum pratensis*, the *Hordeetum murini* association, as well; the vegetation is somewhat higher, the soil less impermeable, cover 90-95 p.c. The dominance of the strongly xerophilous *Glyptobothrus brunneus* T h u n b g. is increasing, and also *Acrida hungarica* H e r b s t can be found. The shading effect of brushwood-heaps enables a special microclimate to be developed being for *Homorocoryphus nitidulus* S c o p .

Ec. type	Area	Species	No.	D p.c.
Hyg.	South Eu.	*Homorocoryphus nitidulus*	1	2,7
Xer.	Med.	*Pezotettix giornae*	7	18,9
Xer.	Palearc.	*Oedipa coerulescens*	2	5,4
Xer.	Cent.Eu.	*Acrida hungarica*	3	8,1
Xer.	Palearc.	*Glyptobothrus brunneus*	8	21,6
Xer.	Palearc.	*Glyptobothrus biguttulus*	+	
Mes.	Eu.-Sib.	*Omocestus haemorrhoidalis*	15	40,5
Mes.	Cent.Eu.	*Euchorthippus declivus*	1	2,7

e. The plant association of the lower regions of dam-side can only be determined with difficulty, it is a variety of the former association strongly overrun with weeds. In this way, also the height conditions are variable, the over is 90-95 p.c. In the fauna, the number of hygrophilous elements is growing.

Ec. type	Area	Species	No.	D p.c.
Hyg.	Eu.-Sib.	*Pezotettix giornae*	11	21,6
Xer.	Med.	*Acrida hungarica*	+	
Xer.	Cent.-Eu.	*Stenobothrus fischeri*	2	4,0
Xer.	Palearc.	*Omocestus ventralis*	6	11,7
Mes.	Eu.-Sib.	*Omocestus haemorrhoidalis*	20	39,2
Xer.	Palearc.	*Glyptobothrus brunneus*	9	17,6
Hyg.	Palearc.	*Chorthippus dorsatus*	1	2,0
Mes.	Cent.Eu.	*Euchorthippus declivus*	2	4,0

5. F e h é r t ó . The steppe of sodic has in floristical respect considerably changed after the fishery being established, and the original vegetation has only remained in a few places. The *Orthoptera fauna* differs in many respects from that of the biotops in the inundation area.

a. In case of *Achillea-Festucetum pseudovinae* /Magyar 28/ S o ó /33/ 45 association the height of vegetation is 3-5-10 /-15/ cm, the cover 60-70 p.c., here and there with alkali spots. All the dominant species are of xerophilous character /*Aiolopus thalassinus* F a b r., *Acrida hungarica* H e r b s t, *Omocestus petraeus* B r i s ., *Glyptobothrus brunneus* T h u n b g./ From the locusts the *Gampsocleis glabra* and *Platycleis affinis* F r i v. are rather rare,

Ec.type	Area	Species	No.	D p.c.
Xer.	Cent.Eu.	*Gampsocleis glabra*	3	3,5
Mes.	Ponto-Med.	*Platycleis affinis*	2	2,3
Mes.	Eu.-Sib.	*Decticus verrucivorus*	+	
Xer.	Ponto-Med.	*Acheta desertus*	2	2,3
Xer.	Palearc.	*Calliptamus italicus*	3	3,5
Xer.	Med.	*Oedaleus decorus*	4	4,8
Xer.	Palearc.	*Oedipoda coerulescens*	6	7,2
Xer.	Med.	*Aiolopus thalassinus*	14	16,8
Xer.	Cent.-Eu.	*Acrida hungarica*	10	11,9
Xer.	Ponto-Med.	*Stenobothrus nigromaculatus*	+	
Xer.	Palearc.	*Omocestus ventralis*	2	3,3
Mes.	Eu.-Sib.	*Omocestus haemorrhoidalis*	3	3,5
Xer.	South Eu.	*Omocestus petraeus*	7	8,4
Xer.	Palearc.	*Glyptobothrus brunneus*	18	21,5
Xer.	Eu.-Sib.	*Glyptobpthrus mollis*	6	7,2
Mes.	Cent.Eu.	*Euchorthippus declivus*	4	4,8

b. A strongly alkalized biotop, lying somewhat higher than the former one, is the plant association *Camphorosmetum annuae*, /R a p a i c s 16/ S o ó 33, vegetation height being 3-5 cm, cover 20-30 p.c. Compared to the former biotop, its number of species is highly decreased. Only xerophilous species can be discovered.

Ec.type	Area	Species	No.	D p.c.
Xer.	Ponto-Med.	*Mantis religiosa*	8	17,5
Xer.	Cent.Eu.	*Campsocleis glabra*	1	2,2
Xer.	Palearc.	*Calliptamus italicus*	1	2,2
Xer.	Palearc.	*Oedipoda coerulescens*	2	4,3
Xer.	Med.	*Aiolopus thalassinus*	19	41,2
Xer.	Palearc.	*Omocestus ventralis*	2	4,3
Xer.	South Eu.	*Omocestus petraeus*	6	13,0
Xer.	Palearc.	*Glyptobothrus brunneus*	7	15,3

c. *Astero-Agrostetum albae*, B o d r o g k ö z y, 60., association with a changing vegetation height cover 95-100 p.c. It is wetter as compared with the former sodic biotops. That is proved by the less xerophilous fauna, with a remarkable species: *Tetrix kraussi* S a u l c y .

Ec.type	Area	Species	No.	D p.c.
Hyg.	Palearc.	*Conocephalus fuscus*	5	7,1
Hyg.	Palearc.	*Tetrix subulata*	6	8,5
Xer.	Eu.-Sib.	*Tetrix kraussi*	2	2,8
Hyg.	Palearc.	*Tetrix tenuicornis*	3	4,2
Xer.	Med.	*Pezotettix giornae*	6	8,5
Xer.	Palearc.	*Calliptamus italicus*	3	4,2
Xer.	Med.	*Oedaleus decorus*	7	9,8
Xer.	Palearc.	*Oedipoda coerulescens*	5	7,1
Xer.	Med.	*Aiolopus thalassinus*	4	5,6
Mes.	Eu.-Sib.	*Omocestus haemorrhoidalis*	12	16,9
Mes.	Cent.Eu.	*Euchorthippus declivus*	18	25,3

6. A s o t t h a l o m . It is the remainder of *Festuco-Quercetum roboris* association, common in the Hungarian Plain for a long time past /B o d r o g k ö z y, 1957/, with a great lot of Mediterranean components in its vegetation. The *Orthoptera fauna* is particularly characteristic and peculiar enough as compared with those in the inundation and sodic biotops.

a. *Pinus nigra* is a planted stand, the height of trees being 50 cm, the soil is a bare sand ridge. A faunistically interesting species is *Acrotylus longipes* C h a r p ., first demonstrated from Hungary by N a g y /1959/. Similarly psammophilous but less rare species are: *Calliptamus barbarus parvus* M a r., *Sphingonotus caerulans* L., *Acrotylus insubricus* S c o p . *Myrmeleotettix antennatus* F i e b .

Ec.type	Area	Species	No.	D p.c.
Xer.	Cent.Eu.	*Platycleis denticulata*	1	1,8
Xer.	Ponto-Med.	*Calliptamus barbarus parvus*	7	12,2
Xer.	Palearc.	*Oedipoda coerulescens*	6	10,5
Xer.	Eu.	*Sphingonotus caerulans*	3	5,3
Xer.	Med.	*Acrotylus insubricus*	15	26,3
Xer.	Ponto-Med.	*Acrotylus longipes*	11	19,3
Xer.	Cent.Eu.	*Acrida hungarica*	4	7,0
Xer.	Palearc.	*Glyptobothrus brunneus*	3	5,3
Xer.	East.Eu.	*Myrmeleotettix antennatus*	6	10,5
Xer.	South Eu.	*Dociostaurus brevicollis*	1	1,8

b. *Festucetum vaginatae danubiale* S o ó 29. association is *Stipa joannis* facies. The height of vegetation is 15-20-35 /-45/ cm, cover 90-95 p.c. The comparatively high vegetation of the wood-clearing enables the occurrence of less xerophilous species. Instead of *Euchorthippus declivus* B r i s. we can discover here *Euchorthippus pulvinatus* F. W. For the *Acrotylus* species the high cover is unfavourable and also other psammophilous species are missing, the frequency of specimens being considerably lower.

Ec.type.	Area	Species	No.	D p.c.
Mes.	Med.	*Phaneroptera quadripunctata*	3	9,4
Xer.	Ponto-Med.	*Calliptamus barbarus parvus*	2	6,2
Xer.	Med.	*Acrotylus insubricus*	1	3,1
Xer.	Med.	*Aiolopus thalassinus*	+	
Xer.	Cent.Eu.	*Acrida hungarica*	1	3,1
Xer.	Palearc.	*Omocestus ventralis*	3	9,4
Xer.	South Eu.	*Omocestus petraeus*	+	
Xer.	Palearc.	*Glyptobothrus brunneus*	17	53,2
Xer.	Eu.-Sib.	*Glyptobothrus mollis*	1	3,1
Hyg.	Palearc.	*Chorthippus dorsatus*	1	3,1
Xer.	Palearc.	*Euchorthippus pulvinatus*	3	9,4

c. *Festucetum vaginatae danubiale , - salicetosum marinifoliae.* /M a g y a r 33/ S o o 39. It is a considerably lower and scattered vegetation, the cover being 80-85 p.c. It is characteristic of the association that the species number is low and that the not expressedly psammophile xerophilous species are dominant.

Ec. type	Area	Species	No.	D p.c.
Xer.	Med.	*Acrotylus insubricus*	2	4,8
Xer.	Ponto-Med.	*Stenobothrus nigromaculatus*	+	
Xer.	South Eu.	*Stenobothrus fischeri*	+	
Xer.	Palearc.	*Omocestus ventralis*	10	23,7
Mes.	Eu.-Sib.	*Omocestus haemorrhoidalis*	2	4,8
Xer.	Palearc.	*Glyptobothrus brunneus*	22	52,4
Xer.	Palearc.	*Euchorthippus pulvinatus*	5	11,9
Xer.	East.Eu.	*Myrmeleotettix antennatus*	1	2,4

d. *Astragalo-Festucetum sulcatae* S o ó /39/ 57 association, *Salix rosmarinifolia* facies. The height of the vegetation grown on hard sand-hills is 10-15-30 cm, cover 90-95 p.c. The dominance of the sand-steppe species is rather high but the number of single specimens in the association is low.

Ec.type.	Area	Species	No.	D p.c.
Xer.	Med.	*Pezotettix giornae*	+	
Xer.	Palearc.	*Oedipoda coerulescens*	1	4,8
Xer.	Ponto-Med.	*Acrotylus insubricus*	3	13,6
Xer.	Cent.Eu.	*Acrida hungarica*	1	4,8
Mes.	Eu.-Sib.	*Omocestus haemorrhoidalis*	2	9,6
Xer.	Palearc.	*Glyptobothrus brunneus*	3	13,6
Xer.	Palearc.	*Euchorthippus pulvinatus*	3	13,6
Xer.	East Eu.	*Myrmeleotettix antennatus*	8	38,4
Xer.	South Eu.	*Dociostaurus brevicollis*	+	

Evaluation of results

At comparing the *Orthoptera* fauna in the investigated areas, I have followed H a r z's /1957/ ecological and biogeographic classification applied before in my works, too. As from the six collecting stations the localities Porgány and Vesszős are near to each other these taken collectively into consideration. In both Tables, the distribution of the Orthontera fauna is given according to the number of specimes.

Distribution of species according to their ecological demands

	Tiszakarád	Tiszakürt	Vesszős + Porgány	Fehértó	Ásotthalom
Hygrophilous	63,59	29,62	23,94	6,96	0,65
Mesophilous	27,19	44,88	30,86	19,38	3,27
Xerophilous	9,22	25,50	45,25	73,66	96,08

Distribution of species according to their biogeographic spectrum

	Tiszakarád	Tiszakürt	Vesszős + Porgány	Fehértó	Ásotthalom
Euro-Siberian	23,47	14,28	23,38	11,43	1,96
Central-European	12,74	26,52	10,47	17,89	4,58
Paleartctic	56,57	32,68	34,18	31,42	50,96
Eastern-European	6,95	7,14	-	-	9,81
Mediterrnaean	-	16,32	30,11	26,84	17,00
Ponto-Mediterranean	-	3,06	0,37	5,96	13,08
South-European	-	-	1,49	6,46	0,65
European	-	-	-	-	1,96

In the Tables the fundamental differences in regard to the geographical site, resp. the soil conditions of the collecting stations are made sufficiently clear. In our case the comparison is, of course, to be applied with due circumspection as we have obtained the material from the single collecting stations on the basis of biotops, resp. collectings of changing numbers. In this way, there may appear rather great differences even between areas lying comparatively near to each other. All the same, biotops like these can be compared with each other if there are between them considerable differences of distance or soil structure.

We can easily observe the progressivity concerning the biotops in the Tisza basin(advancing in N-S direction, the percentage of xerophilous species highly increases. In the sodic and sandgrass associations the role of the xerophilous species is still more important and the hygrophilous species do change with an opposite sign.

Some progressivity can be observed in the distribution according to the biogeographic spectrum, as well. That could be much more obvious if the collectings gave the picture of an identical phase in the same year. N a g y /1943/ regards the effects of aspect changes at the *Saltatoria* populations to be considerable, and also B a l o g h and L o k s a /1948/ drew a similar conclusion. The yearly changes of the single specimes of *Pezotettix giornae* R o s s i, that showed masses between 1964 and 1966 in the biotops at the Southern Tisza, at the collections in 1969 in the same area appeared to be much lower. And as it exerted a considerable influence on the percentage of the specimens of the species of Mediterranean distribution, even the number of specimens of Mediterranean distribution, that is generally much higher in the sand-grass areas, could not be manifested. For eliminating failures like these, it is absolutely necessary that the collectings take place in nearly indentical periods.

Taking all these into consideration, we may establish that the percentage of the occurrence of the Ponto-Mediterranean and Mediterranean species in the Southern region of the Tisza basin and in case of the sand-grasses is much higher as compared with other biotops. To a lesser extent, the same holds in respect of the South-European species and, with an opposite sign, of the Euro-Siberian elements. In the collecting stations of the Upper-Tisza there may occur also mountain elements /*Stenobothrus lineatus* P a n z, *Bicolorana bicolor* P h i l./, The palearctic species occur generally with a considerable amount in the biotops of any type, owing to their higher ecological tolerance limit.

The collections of Vesszős and Porgány give the conditions of the *Saltatoria* populations at both banks of the river in an identical height. The cause of differences may be found in that the river deposits different sediments on the two banks. Thus, in the present case, the soil is richer at the collecting stations of the left bank. /Porgány/ in sand fraction, and at that of the right bank /Vesszős/ in silt fraction. The soil conditions exert an influence on the populations of these territories indirectly, through the vegetation.

Summary

In the course of collections in the Tisza basin, in sodic, resp. sand-grass biotops, there have been collected 2365 specimens of 47 species from six collecting stations and inside them from 22 collecting areas.
From faunistical point of view significant species are: *Bicolorana bicolor* P h i l ., *Platycleis denticulata* P a n z., *Acrotylus longipes* C h a r p., *Stenobothrus lineatus* P a n z., *Calliptamus barbarus parvus* M a r .

In the various biotops the following *Saltatoria* populations could be established: /1/ Ecotone of the inundation area of the Northern region of river: *Chorthippus albomarginatus - Leptophyes albovittata* Tiszakarád a,b/; /2/ dryer grass-land on the dam-side: *Euchorthippus declivus - Omocestus haemorrhoidalis* /Tiszakürt, Vesszős b, d, e, Porgány b,c,d,e, Fehértó c/; /3/ grass-land in the inundation area overrun with weeds: *Omocestus haemorrhoidalis - Glyptobothrus brunneus* /Vesszős c, Porgány f/ /4/ wetter grass-land in the inundation area overrun with weeds: *Homorocoryphus nitidulus - Tetrix subulata* /Vesszős f, Porgány a/; /5/ sodic pasture: *Glyptobothrus brunneus - Omocestus petraeus - Aiolopus thalassinus* /Fehértó a,b/; /6/ Bare sand-ridge: *Acrotylus longipes - Acrotylus insubricus - Calliptamus barbarus* /Asotthalom a/; /7/ *Needlegrass-sandgrass; Glyptobothrus brunneus - Euchortippus pulvinatus* /Asotthalom b,c/; /8/ Half-hard sandgrass: *Myrmeleotettix antennatus - Acrotylus insubrucus* /Asotthalom d/.

All these populations are showing a great enough difference as compared with N a g y ' s /1949/ collectings in Tihany; that is, anyway, natural owing to the various biotops. However, as a result of the collectings carried out in a limited number, the results are to be received with some critique.

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About the oribatid fauna of the Tisza basin /Oribatida, Acari/

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Abstract

The paper contains an enumeration of some oribatid mites discovered during investigation of the soil hardwood and softwood groves. The investigations took place in ten different collecting stations where 53 mite species were discovered. Three species of them: *Epidamaeus affinis*, *Metabelba monilipeda*, *Eupelops uraceus* were so far not demonstrated in the fauna of the Carpathian basin. The paper contains also a short description of these species.

Introduction

Our country can be considered as an area elaborated well enough from oribatidological point of view. From the Great Hungarian Plain, however, we know but a few data, first of all concerning the basin of the Tisza and its tributaries. In this paper the oribatid species discovered in the soil of the inundation groves of the Tisza and Körös are described. The results are of faunistical significance but I give to the ecology of the single species also the plant associations where the collections took place.

The species collected are published in taxonomical order, on the basis of B a l o g h's work published in 1963.

Collecting stations

A/1. Szeged-Boszorkánysziget /*Salicetum albae-fragilis* I S S L E R , February 28th 1969.

A/2. Szeged-Boszorkánysziget /*Alopecuretum pratensis-festucetosum pseudovinae*/S O Ó/, February 28th 1969.

B/1. Békéscsaba-Gerla /*Fraxino pannoniacae-Ulmetum pannonicum* S O Ó/, April 8, 1969.

B/2. Békés-Tarhos /*Festuco (pseudovinae)-Quercetum roboris* M Á T H É/, April 26th 1969.

B/3. Gyula-Szanazug /*Festuco(pseudovinae)-Quercetum roboris* M Á T H É/, April 26th 1969.

C/1. Alpár-Tőserdő /*Convallario-Quercetum danubiale* S O Ó/, April 30th 1969.

C/2. Alpár /*Fraxino pannonicae-Alnetum* /Soó et K O M L Ó D I/, April 30th 1969.

D/1. Poroszló /*Salicetum albae-fragilis* I S S L E R/, July 30th 1969.

D/2. Poroszló /*Salicetum albae-fragilis* I S S L E R/, Wood grown by

Vitis silvestris/, August 2nd 1969.

D/3. Poroszló /*Salicetum albae-fragilis* I S S L E R /, young wood, started up from a clearing/, August 2nd 1969.

List of species collected

H Y P O C H T H O N I I D A E B E R L E S E, 1910
Hypochthonius luteus O U D E M A N S, 1913. B/2, B/3, C/2.

E N I O C H T H O N I I D A E G R A N J E A N, 1947.
Eniochthonius minutissimus B E R L E S E, 1904. B/1, B/2, B/3, C/1.

P H T H I R A C A R I D A E P E R T Y, 1841.
Stegnacarus striculus C. L. K O C H, 1836. A/1, C/2.
Phthiracarus piger S C O P O L I, 1763. B/2, C/2,
Phthiracarus anonimum G R A N D J E A N, 1933. B/2, B/3, C/2, D/1, D/2.

E U P H T H I R A C A R I D A E J A C O T, 1930
Rhysotritia ardua C. L. K O C H, 1841. A/1, A/2, B/1, B/3, D/1, D/3.

N O T H R I D E A B E R L E S E, 1896
Nothrus biciliatus C. L. K O C H, 1844. B/2, C/2, D/3.

C A M I S I I D A E O U D E M A N S, 1900
Camisia horrida H E R M A N N, 1804. C/2, D/1.
Camisia biurus C. L. K O C H, 1840. D/2.
Platynothrus peltifer C. L. K O C H, 1839. A/1, A/2, B/3, C/1, C/2, D/1.

T R H Y P O C H T H O N I I D A E W I L L M A N N, 1931
Trhypochthonius excavatus W I L L M A N N, 1919. D/1.

N A N H E R M A N N I I D A E S E L L N I C K, 1928.
Nanhermannia elegantula B E R L E S E, 1913. C/2.

D A M A E I D A E B E R L E S E, 1896
Damaeus /Spatiodamaeus/verticillipes N I C O L E T, 1855.
A/1, A/2, B/1, B/2, B/3, C/2, D/1, D/2, D/3.

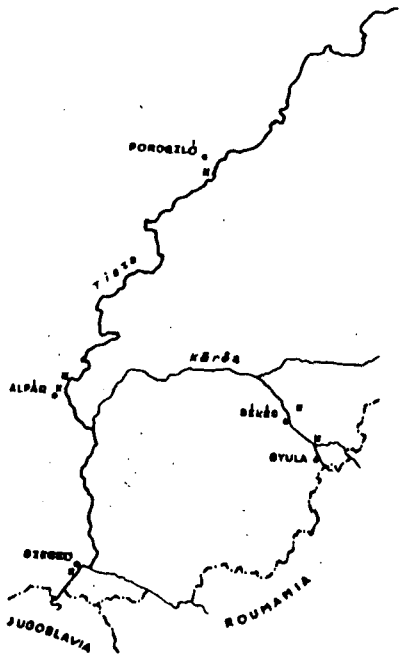

Fig.1. Map of collecting stations

Epidamaeus affinis B U L A N O V A - Z A C H V A T K I N A, 1957. A/1, C/2, D/1.

It is a new species for the fauna of the Carpathian basin. It is an animal of dark brown. The parastigmal apophyses are similar, narrow, parallel with each other. The protrusion of *propodosoma* between legs I. and II is rounded, low. There are two pairs of propodosomal tubercles, the internal one taking place under the anterior exostigmal hair, the external one under the *bothrydium*. The external propodosomal tubercle is stronger developed than the internal one, and is "V"-or crescent-shaped; the inner one extends from the tubercle till the *bothrydium*. The *sensillus* is a strong, long bristle, covered with small hair, being straight or broken at its root a little forwards or unwards. The anterior exostigmal hair is needle-shaped, straight, pointing backwards; the posterior one is short, standing forwards and being curved. There is a long, narrow *spinae adnatae*, pointing to the middle-line of the body. The *notogaster* is of spherical form. The hair of *notogaster* is long, thin, smooth, and lying in two longitudinal lines. The anterior four pairs of hair point forwards, the other ones backwards /Fig. 2/.

Length: 670 µ., width: 410 µ.

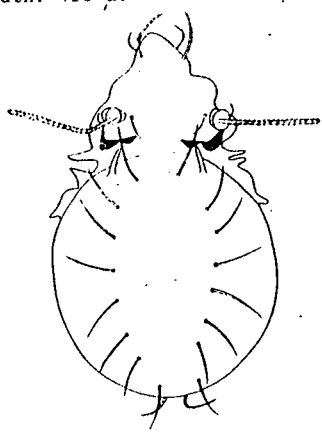

Fig. 2. *Epidamaeus affinis* BULANOVA-ZACHVATKINA, 1957

The species is described from the environs of Moscow where it was recovered in the leaf-litter of a mixed wood /B u l a n o v a - Z a c h v a t k i n a, 1957/.

Metabelba pulverulenta C. L. K O C H, 1840. A/1, A/2, B/1, B/2, B/3, C/1, D/3.

Metabelba papillipes NICOLET, 1855. B/1, B/2.

Its colour is dark brown. The protrusion of proterosoma between leg-pairs I and II is well-developed, pointing forwards. There are a pair of propodosomal tubercles, opposite to which there are a pair of tubercles on the *hysterosoma*, too. The sensillus is getting gradually thinner, whip-shaped, it is increased about threefold as compared with the anterior exostigmal hair. The parastigmal apophyses are not equal, the anterior one /a.p.a./ is narrow, pointed, standing at side; the posterior one /a.a.p./ is thick, its point stands at right angles to the former one. The *hysterosoma* is of spherical form. The back-hair is smooth, equally long, standing radiating in two longitudinal lines. *Tibia* IV is shorter than the *femur* /Fig.3/.

Length: 450 µ, width: 280 µ.

Finding places were so far: Kursk, Sub-Carnathia /B u l a n o v a - Z a c h v a t k i n a 1965/. Szemenye and Székesfehérvár /Balogh, Kassai and Mahunka 1965/.

Metabelba monilipeda B U L A N O V A - Z A C H V A T K I N A, 1965. C/2.

It is a new species for the fauna of the Carpathian basin. It is a dark brown animal. The protrusion of *propodosoma* between legs I and II is blunt, undeveloped. The fore-part of *rostrum* is cut, its corners are rounded. It

has a pair of propodosomal tubercles, their points touching a pair of hysterosomal tubercles. The posterior exostigmal hair is long, whip-like, its length is hardly shorter than the sensillus. The *sensillus* is whip-like. The lamellahair is much stronger than the rostral one, and is serrated. Among the parastigmal apophyses there is a triangle-shaped exsection pointing outwards with its tip, and thus the tips of the apophyses get to each other. The back-hair is smooth, ordered in two longitudinal lines, standing radiated /Fig.4/.

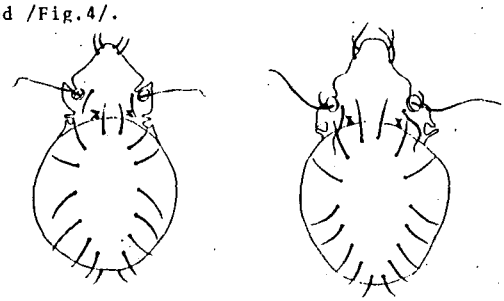

Fig. 3. *Metabelba papillipes* NICOLET, 1855
Fig. 4. *Metabelba monilipeda* BULANOVA-ZACHVATKINA, 1965.

Length: 480 u, width: 300 u.
Described by B u l a n o v a - Z a c h v a t k i n a from a pine-wood, in Teberd /1965/.

E R E M A E I D A E S E L L N I C K, 1928

Eremaeus oblongus C.L. K O C H, 183 . C/2, D/3.

M E T R I O P P I D A E B A L O GGH, 1943
Ceratoppia bipilis HERMANN, 1840. B/1, B/3, C/2, D/1, D/2, D/3.
Ceratoppia sexpilosa WILLMANN, 1938. B/1.

L I A C A R I D A E S E L L N I C K, 1928
Liacarus coracinus C. L. K O C H, 1840. A/1, A/2, C/1.
Xenillus tegeocranus HERMANN, 1804. C/2.

T E N U I A L I D A E J A C O T, 1929
Hafenrefferia gilvipes C. L. K O C H, 1840. C/2.

C A R A B O D I D A E C. L. K O C H, 1837
Carabodes labyrinthicus M I C H A E L, 1879. C/2.

TECTOCEPHEIDAE GRANDJEAN, 1954.

Tectocepheus sarekensis TRAG., 1910. A/1, B/2, B/3, C/1, C/2, D/2, D/3.

OPPIIDAE GRANDJEAN, 1954

Oppia ornata OUDEMANS, 1900. A/1, B/1, B/2.
Oppia splendens C. L. KOCH, 1840. A/1, D/1, D/2, D/3.
Oppia nitens C. L. KOCH, 1836. D/2.
Oppia subpectinata OUDEMANS, 1901. B/2, B/3, C/1.
Oppia unicarinata PAOLI, 1908. B/1, C/2.
Oppia bicarinata PAOLI, 1908. C/2, D/2.
Oppia clavipectinata MICHAEL, 1885. B/2.
Quadroppia quadricarinata MICHAEL, 1885. C/2.

SUCTOBELBIDAE GRANDJEAN, 1954

Suctobelba sp. C/1.

PELOPIDAE EWING, 1917

Eupelops tardus C. L. KOCH, 1836. A/1. A/2.
Eupelops uraceus C. L. KOCH, 1840. C/2.
It is a new species for the fauna of the Carpathian basin. Its colour is dark brown. The *lamellae* are pointed leaf-shaped, bending somewhat towards one another, overlapping the *rostrum*, their root being covered with the wavy-edged collar of the *hysterosoma*. The *bothrydium* is at the contact of this projection and the *pteromorpha*, not entirely covered.
The *sensillus* is somewhat thicker, spindle-like, with a rounded end. The back is covered with thick *excreta*, engraved with an irregular drawing. Hair S3 and R3 is thickenned, barbed, the other back-hair simple.

It is not identical with *Phenopelos uraceus*, contained in Sellnick's /1960/ determination. I have determined it according to Willmann /1931/ /Fig.4./

Length: 680 u, width: 510 u.

Described from Regensburg /Willmann, 1931/.
Eupelops sp. B/2, B/3, C/1.

ACHIPTERIIDAE THOR, 1929

Achipteria coleopterata LINNAE, 1758. A/2, C/1, C/2.
Parachipteria punctata NICOLET, 1855. B/2, B/3, C/1, C/2.
Anoribatella ornata SCHUSTER, 1958. A/1.

ORIBATELLIDAE JACOT, 1925

Oribatella reticulata B E R L E S E, 1916. B/2, A/1, A/2.
Ophidiotrichus connexus S E L L N I C K, 1908. C/2.

T E G O R I B A T I D A E G R A N D J E A N, 1954

Lepidozetes singularis B E R L E S E, 1910. A/1.

M Y C O B A T I D A E G R A N D J E A N. 1954.
Minuthozetes pseudofusiger S C H W E I Z E R, 1922. C/2.

C H A M O B A T I D A E G R A N D J E A N, 1954
Chamobates cuspidatus M I C H A E L, 1884. C/2.

G A L U M N I D A E G R A N D J E A N, 1956
Galumna lanceata O U D E M A N S, 1900. B/2, B/3.
Pergalumna nervosa B E R L E S E, 1914. C/1, C/2.
Pergalumna sp. C/2, D/1.
Pilogalumna tenuiclava B E R L E S E, 1908. B/1, C/1.

O R I B A T U L I D A E T H O R, 1929
Oribatula tibialis N I C O L E T, 1855. C/2, D/3.
Liebstadia similis M I C H A E L, 1888. C/1, C/2, D/1, D/3.
Scheloribates laevigatus C. L. K O C H, 1836. A/1, A/2, B/2, C/1, C/2, D/1, D/2, D/3.

H A P L O Z E T I D A E G R A N D J E A N, 1936
Protoribates capucinus B E R L E S E, 1908. A/1, A/2.

I am grateful to Dr. S. M A H U N K A for the control of my determinations.

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TISCIA /SZEGED/ 6, 1970-71

Malacocoenoses of backwaters of the Upper Tisza with various vegetations

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Abstract

The author has carried out malacocoenological investigations in four various plant associations belonging to the association series *Hydrocharietalia* R ü b e l 1933 and *Potametalia* K l i k a 1944. The populations of Mollusks of the various reed-grass associations cannot be identified with mathematical methods, although more species are common in the single populations. The *synusia* found in the reed-grass associations are characterized by two-two species of obvious characteristics. In the *synusia*, the *ratio* of the juvenile specimens is high, the species number and the total number of specimens is comparatively low.

Introduction

The malacocoenological conditions of the backwaters along the Tisza are so far unknown. About their snail fauna there are sporadic data to be found in the works of C z ó g l e r /1935/, H o r v á t h /1957, 1958, 1962, 1964/. B á b a /1967/. Coenological investigations were carried out so far by the author /1967/ in one of the backwaters of the middle reaches of the Tisza.

The backwaters along the Upper Tisza are less disturbed than those in other reaches of the Tisza. The purpose of my investigations was to establish the elementary population types as they developed in the various reed-grass vegetations.

Time, site, and method of the collection

My coenological collections originate from three backwaters in the area of the community Kisar /June 22-27 1967/ and from a backwater beside the community Tiszakerecseny /August 24-26 1968/. In the environs of the community Kisar I collected from two backwaters in the inundation area at the right side of the Tisza, and from one backwater in the inundation area at the left side, in the height of 723, 725, 728 rkm. /In Table 1, I have performed the determination of the position by the help of rkm-s/.

I have collected from the 5-25 cm deep riparian waterstrines of the backwaters. My methods agree with those described in my investigations of the backwaters at Szikra: B á b a /1967/. The comparison of *synusia* was carried out with the help of R a m s a y 's formula controlled by P ó c s /1966/, on the basis of the identity of species and constancy. The coenological characteristics are contained in Table 1. The Table contains, apart from the list of species, also the total specimen number of species /sum/, the percentage of juvenile specimens as compared with the total number of specimens /juv. n.c./, the dominance percentage /D n.c./, and the constancy percentage /C n.c./.

I have compared my results with those observed in a backwater at an earlier investigation: B á b a /1967/.

My plant coenological data have been supervised by jun. univ.lecturer Dr. Gy. B o d r o g k ö z y

Vegetation of the backwaters

The four backwaters investigated are members of association series having different vegetations: S o ó /1964/.

The Tisza of "Mrs. J. K i s s " lying in the height of 723 rkm at Kisar belongs to the *Hydrochari-Stratiotetum* /Langendonck 1935/ association of the association series *Hydrocharietalia* R ü b e l 1933. The backwaters found in the height of 725 rkm in the inundation area on the right side, at Kisar, as well as in the height of 728 rkm in the same inundation area, and at Tiszakerecseny, are members of the *Potametalia* K l i k a 1944 association series. The vegetation of the backwater lying in the height of 725 rkm is formed by the *Trapa natans* facies of *Nymphoidetum peltatae* /A l l o r g e 1922/. The vegetation of the backwater being in the height of 728 rkm is the *Nymphaeetum albo-luteae* Nowinski 1928. *nymphaeetosum* K á r p á t i V. 1963. facies. The vegetation of the backwater at Tiszakerecseny is: *Trapetum natantis* Müller-Görs 1960.

Species discovered, oecological observations

In the four backwaters I have discovered 14 species and the varieties of two species /cf. the list of species in Table 1/. The species found are generally distributed in the home and Central-European waters of different types. The fauna of the backwaters are separated from those in other types by differences concerning the composition and number of species. The composition and amount of species changes even according to the state of water and vegetation of the single backwaters. The snail species were found on various plants and plant fragments. Only *Viviparus fasciatus* O. F. M ü l l. and *Gyraulus crista* var. *nautileus* L., as well as two shell species were found on the soil. /At the same time, *Gyraulus crista*, L. stayed on the leaf of *Potamogeton crispus* L., close to the water surface. /Also three young specimens of *Sphaerium corneum* L. were found among the roots of the floating *Stratiotes aloides* L. The fewest snail species were found on the plant

Trapa natans L. I could collect from that plant only a few *Lymnaea auricularia* L. specimens and some *Acroloxus lacustris* L. specimens.

The Mollusks discovered were in various states of development. In all the four backwaters I have found some ovumbunches of *Lymnaea ovata* D r a p, resp. of L. *ovata* var. ampla H a r t m . /In Tiszakerecseny, e.g. 9 ovule-bunches were found/. I have found in one specimen of *Viviparus fasciatus* O.F. M ü l l. 33 embryos of 2 to 2.1 mm. The number of ova in the ovum-bunches corresponds to the data published by F r ö m m i n g /1956/. The size of the *Lymnaea ovata* var. *ampla* H a r t m . that crept out of the smallest yolk bag was 0,90: 0,55 mm. We have got more embryonal specimens of the species *Hippeutis complanatus* D r a p., as well. And I collected a great lot of embryonal specimens of the species *Sphaerium corneum* L., too. Their size was: 0,16-0,20: 0,20-0,22: 0,05-0,10 mm.

The specimens of various size and the ovum-bunches found prove the continuous multiplication of the water Mollusks in the summer season.

Coenological analysis

The single *synusia* differ from each other according to their vegetations.

To the plant association *Hydrochari-Stratiotetum* L a n g e n d o n c k 1935 corresponds a Mollusk *synusium* of the type *Gyraulus albus-Planorbarius corneus*, containing 9 species. In the *Nymphoidetum peltatae* A l l o r g e 1922 association a *synusium* of *Viviparus fasciatus-Planorbarius corneus* type came about.
In the *Nymphaeetum albo-luteae* N o w i n s i 1928 association a *synusium* of the type *Sphaerium corneum-Viviparus fasciatus* can be found, with the subconstant component *Planorbarius corneus* L. The *Trapetum natantis* M ü l l e r - G ö r s 1960 association may be characterized with the *synusium* type *Hippeutis complanatus-Acroloxus lacustris*, and the dominant species *Lymnaea ovata* D r a p.

The number of species in the single *synusia* moves between 6-9. The highest total number of specimens, 167, was found in the *Sphaerium corneum-Viviparus fasciatus synusium*. Here was the Sphaerium corneum L. alone represented with 136 specimens. In the other *synusia*, the total individual number was, in the order of their description, 64, 71 and 112. Only in the *Viviparus fasciatus-Planorbarius corneus synusium* does not reach the ratio of juvenile specimens compared to the full-grown ones the 50 per cent /it is 46 p.c./. In the other *synusia* it moves between 69-84 p.c.
It is characteristic of the water *synusia* described that, apart from the eponymous two constant-dominant species, there occurs at most one subconstant or dominant species. The other species of *synusia* have but low characteristics /Table 1/.

Although in all the reed-grass associations described there occurs the *Planorbarius corneus* L., resp. in the most of them also the *Viviparus fasciatus* O.F. M ü l l. and *Acroloxus lacustris* L., and in addition, in the single associations, also other common species are to be found, neverthless, we cannot speak about a species identity because its calculated values are moving only between 14-40 p.c. The same is characteristic of the constant-identities, too /16-40 p.c./. We find only between the *Gyraulus albus-Planorbarius corneus* and *Viviparus fasciatus-Planorbarius corneus synusia* a species indentity of 60 p.c. The constancy-identity is, however, only 42 p.c., their immediate identification is, therefore, not possible.

Summary

It appears from the described data that: 1. The water mollusk populations differ from each other concerning the quality and quantity of species corresponding to the single plant associations. This conclusion is confirmed by my investigation carried out in the backwaters at Szikra is the Central Tisza /Bába 1967/. In the reed-grass associations investigated the species number is low /6-9/.

The total number of individual specimens is not high, generally the characteristics of the two species are striking. At the other species they are very low. 3. In the various reed-grass associations various plants take part, and corresponding to the vegetation also the detritus-formation is different. It is easy to understand that the here and there common *Gasteropoda*, too, that participate in the populations, are represented with different distribution and mass relations. 4. In harmony with my earlier investigations /Bába 1967/, it is supported by the size conditions of the snails in the four backwaters investigated that both the land and the water snail species can multiply during the whole year.

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List of species and the corresponding coenological characteristics.

Table I.

No.	A r t	723 river km at Kisar.				725 river km at Kisar				728 river km at Kisar				Tiszakerecseny			
		Summa	Juv. p.c.	D %	C %	Summa	Juv. p.c.	D %	C %	Summa	Juv. %	D %	C %	Summa	Juv. %	D %	C %
1.	*Viviparus fasciatus* O.F. Müll.	4	50	6,25	40	41	87	57,74	70	9	66	4,91	80	-	-	-	-
2.	*Lymnaea truncatula* O.F. Müll.	-	-	-	-	-	-	-	-	5	80	2,75	20	3	33	2,67	30
3.	*Lymnaea stagnalis* L.	8	-	12,50	60	3	-	4,22	30	4	-	2,15	30	3	-	2,67	30
4.	*Lymnaea auricularia* L.	-	-	-	-	7	28	9,85	40	-	-	-	-	-	-	-	-
5.	*Lymnaea ovata* var. *ampla* Hartm.	6	83	9,37	40	2	100	2,81	20	5	60	2,75	30	-	-	-	-
6.	*Lymnaea ovata* Drap.	-	-	-	-	-	-	-	-	-	-	-	-	61	96	54,46	20
7.	*Lymnaea peregra* O.F. Müll.	1	100	1,56	10	1	100	1,40	10	-	-	-	-	-	-	-	-
8.	*Physa fontinalis* L.	-	-	-	-	-	-	-	-	-	-	-	-	2	100	1,78	10
9.	*Planorbarius corneus* L.	7	28	10,93	70	8	50	11,26	70	8	25	4,31	60	10	80	8,92	50
10.	*Gyraulus crista* var. *nautileus* L.	17	76	26,56	40	-	-	-	-	-	-	-	-	-	-	-	-
11.	*Gyraulus crista* L.	1	100	1,56	10	-	-	-	-	-	-	-	-	-	-	-	-
12.	*Gyraulus albus* L.	14	28	21,87	70	-	-	-	-	-	-	-	-	4	75	3,57	10
13.	*Hippeutis complanatus* Drap.	-	-	-	-	-	-	-	-	-	-	-	-	18	100	16,16	70
14.	*Acroloxus lacustris* L.	6	33	9,37	40	3	-	4,22	30	-	-	-	-	11	38	9,82	60
15.	*Anodonta cygnaea* f. *zellensis* Cmelin.	-	-	-	-	6	83	8,45	30	-	-	-	-	-	-	-	-
16.	*Spaerium corneum* L.	-	-	-	-	-	-	-	-	136	73	81,43	100	-	-	-	-
	Zusammen:	64	46	100	-	71	70	100	-	167	69	100	-	112	84	100	-

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Bird-coenological investigations in the inundation area of the Maros

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Abstract

My avicoenological investigations in the inundation area of the Maros were carried out in rotten old willow-plantations and in fine poplar-plantations of an unmixed stand, in the winter months, from 1966 until 1968.

I have elaborated also the bird-coenoses of the biotops occurring in the area.

The results of the coenological investigations are supported by my observations in the subsequent year. In so far as the number of species and individuals of the overwintering birds is similar in the same area in every year, there come into being identical bird-coenoses corresponding to the single biotops.

Introduction

My bird-coenological investigations were carried out in the inundation area of the Maros, from October 1966 till March 1968. These areas were under my detailed observation already in the period 1962-1966, and my perceptions obtained in that time have been used to my definitive results of investigations.

A short oecological characterization of the area is as follows. My investigations were carried out in three different areas. Two of them were noble poplar plantations and one was an old willow plantation.
Apart from them, I have studied also a young willow plantation from the point of view of bird populations. The areas investigated lie between the zero three km reaches of the Maros. I have chosen the boundary of the areas so that, during my observations, the bird migration between the single areas should be comparatively little.

Climate characteristics: Mean annual temperature + 10 ^{o}C. Number of frosty days /with sub-zero temperature till -10 ^{o}C /not more than 8-12 days / K a k a s 1960/. The coldest winter month in January with a mean monthly temperature -3 ^{o}C. The amount of precipitation in the winter semester is 250 mm but the annual average of the snowy days is only 20 mm. The area is covered with snow generally from December 20th till February 15th. And the number of snow-covered days is often much more lower than that.

My investigations were carried out from November 1st till March 1st.

Coenological investigations in an old willow-plantation of pure stand

The stand of the willow plantation is very old /60-80 years old plantation/. It is 1050 m long, 60 m broad, 6,3 Ha extent. It is surrounded by a plough-land from South, by a 20 m broad rare poplar plantation from North, and beyond that also by plough-lands.

The numbers of the species and of their specimens occuring constantly in the area are as follows:

Falco tinnunculus / L./: one male specimen could systematically been observed.

Phasianus colchicus / L./: 4-6 specimens. Their relatively small number can be explained by the absence of a dense underwood.

Asio otus / L./: 10-13. They spend the daytime in a group on willows. 99 p.c. of their food are small rodents. Their number changes periodically in years.

Dendrocopus major / L./, *Dendrocopus syriacus* / E h r e n b e r g /: I have systematically observed two of them. They cleaned the branches, rotten stems of willows. *Parus major* / L./: Their average number has been 14. The greatest single number was in early November: 24. In March I observed 6-8 fewer than those observed in November.

Parus coeruleus / L./: Their number shows the maximum in January, then it is 10-12, but generally there occur only 4-5 specimens.

Aegithalos caudatus / L./: They occur systematically only in November or early December, as well as in February. Then I discovered them in a small group of 4-5. In January they could be seen rarely but in a very large pack /12-15/: mainly *Aegithalos caudatus europeus* / H e r m a n n /.

Certhia brachydactyla / B r e h m /: I have seen 2-3 specimens straying with tomtit packs. They are the most constant species of the area. In March their number increased to 4-5.

Turdus merula / L./: Apart from the snow-covered days, I have constantly discovered 2-3 specimens.

Regulus regulus / L./: Their number is subjected to a very great fluctuation. In a snowy weather their number decreases. I have found 8-9 specimens on the average.

Regulus ignicapillus / T e m m i n c k /: It is very rare.

Passer montanus / L./: From the middle of December till the middle of February they come here only for night. Their number is almost constant, 13-15.

Troglodytes troglodytes / L./: They stay at the denser underwood of the area, number: 1-3.

Summing up the results of the observations so far: In the area of 6,3 Ha, there are systematically represented 14 species: 13 birds for a hectare. The total weight of these specimens is small but their biological role is priceless.

Coenological investigation in noble poplar plantations

The age of the poplars is 13-14 years. The two areas are together 15 Ha /3,6 + 11,4/. The poplar plantation of 3,6 Ha is surrounded by the river Maros, an old willow plantation, and a young willow plantation. Here there gets on only the bird-diverting effect of the willow plantations but I took always care of having real results. The poplar plantation of 11,4 Ha area is surrounded by a plough-land, the river Maros, as well as a one-year old willow plantation. This area is comparatively well isolated.

The species constantly occurring in the area are as follows. Their numerical determination, apart from a few species, is very difficult. A lot of species visits, the area only for 1-2 hours or for a still shorter period. The area seems, therefore, to be often desolate, nevertheless it is in a constant motion.

Dendrocopos major / L./, *Dendrocopos syriacus* / E h r e n b e r g /: They stay at the poplar plantation for the whole winter. I have mostly observed 3 specimens.

Parus major / L./: I have seen on the average four of them, in mixed groups with continental blue tits. In November and March their number was 15-20.

Parus coeruleus / L./: much more frequent than the tit species mentioned above, although their number is in a strong fluctuation. There occur 7-8 of them on the average but I often met groups of 15-20 specimens, as well.

Troglodytes troglodytes / L./: in snow-free periods, among the fallen twigs and in the denser underwood there occurred 2 of them on the average.

Turdus merula / L./: in snow-free periods 4-6 specimens stayed at the area.

Regulus regulus / L./: There were 2 specimens on the average. Their number is strongly fluctuating, they occur in mixed packs with blue tits. *Regulus ignicapillus* / T e m m i n c k /: is a very rare guest.

Carduelis carduelis / L./: They come in packs containing 30-40 specimens. They are often absent from the area. The cause of this is that they come here mostly for taking a rest. On the average L, 3 of them are in the area.
Carduelis spinus / L./: As long as there are leaves on the trees, they come here in packs of 20-25 specimens and consume insects. In winter, I have seen only one or two specimens in overflight.
Pyrrhula pyrrhula / L./: It is a species connected with the presence of ashtrees. It can be observed in packs of 3-5 or 10-20 specimens. Their specimen number in the area is 15 on the average.

On single occasions I have met the following species: *Falco tinnunculus, Phasianus colchicus, Columba palumbus, Picus viridis, Turdus philomelos, Turdus pilaris, Aegithalos caudatus, Erithacus rubecula, Carduelis chloris, Fringilla coelebs, Corvus corone cornix, Pica pica, Accipiter nisus, Buteo buteo, Passer montanus, Fringilla montifringilla.*

I have observed, therefore, 27 species in an area of 15 Ha /17 of them only on single occasions/. They were represented with 54 specimens, for one hectare there were 3,6 birds.

Bird populations of the area

I. Winter bird population in the inundation willow plantations of pure stand

1. Old /60-80 years old/ tree stand: coal tit, blue tit, fire-crested wren, tree-creeper, tree-sparrow, long-tailed tit, big woodpecker, wood long-eared owl.
2. Young /6-25 years old/ willow stand: coal tit, blue tit, fire-crested wren, long-tailed tit, big woodpecker.

Name of the populations: 1. coal tit, fire-crested wren, blue tit, tree-creeper.
2. coal tit, blue tit, fire-crested wren.

II. Winter bird population in the inundation noble poplar plantations.

1. Blue tit, coal tit, bullfinch, fire-crested wren, big woodpecker, long-tailed tit. The existence of this population depends on the presence of the bearer ash-trees.
2. Blue tit, coal tit, fire-crested wren, woodpecker, bullfinch, long-tailed tit. The presence of the bullfinch in the noble poplar plantations is connected with the cron of ash-trees. After its exhaustion, their presence in the area is not systematic.
Name of the population: blue tit, coal tit.

III. Dense mulberry-shrubby places

Robin, blackbird, jenny wren, wood hedge-sparrow. Owing to strong cold weather and snow, the robin and blackbird leave the population.
Name of the population: Jenny wren, robin, blackbird.

IV. Abnormal areas beside the banks

Goldfinch, siskin, wood finch, jenny wren, fir-finch, green-finch, blackbird. The main mass of vegetation is given by *Xantium italicum* / M o r /, the crop of which is the main food of the goldfinches.
Name of the population: Goldfinch.

V. D a m

Yellow-hammer, linnet, tree-sparrow, skylark, starling, rook, fieldfare, jackdaw, reed-bunting, green-finch. It is a mown area covered with plant association of varied composition.

In the winter month the vegetation is 5-10 cm high /first of all *Gramineae*/. It cannot be named a constant association. The presence of species depends strongly upon the weather.
Name of population: Yellow hammer, linnet.

Formation of bird-packs in the winter months

From the end of winter the standing birds of the inundation area already roam in packs but they consist, in that time, only of one family /4-11 specimens. From the middle of October as the fire-crested wrens arrive, mixed packs are formed. The number of species and specimens in a pack shows a very great variety.

I observed the first mixed pack on the 22nd of October and then continuously till the early April. Then there separate first the long-tailed tit, then the coal tit, and after the fire-crested wrens leaving, the bird-pack dissolves. The specimen numbers of the species participating in the packs change between 3 and 7 but the specimen numbers of a few species can be shifted to 15-22, too.

Packs of pure stock are: coal tit 3-25, blue tit 3-20, long-tailed tit 4-15, tree-creeper 3, fire-crested wren 3-15, goldfinch 2-150, bullfinch 2-30, siskin 2-40, skylark 2-80.

Packs of mixed stock are: the birds of inundation the most frequently form mixed packs. I have so far found only bullfinch in a pack of a constantly pure stock what can be explained with the quality of the demand on food. /The crop of ash-tree is consumed only by that bird/.

I observed a pack of mixed composition the earliest on October 22nd 1966, consisting of the following species: 4 fire-crested wrens - 6 long-tailed tits- 2 coal tits - 1 blue tit. The packs of a composition like this are very frequent ones. They may be joined also by tree-creepers, big woodpeckers, wrens, robins.

The most frequent mixed packs are: coal tit - blue tit; blue tit - fire-crested wren;. coal tit - blue tit - tree-creeper; fire-crested wren - tree-creeper; coal tit - tree-creeper; yellow-hammer- linnet; starling - fieldfare.

Summary

The coenological investigations are proved by my observations from 1967/1968, the results of which are very similar to the data of the year before. In the same area the species and specimen numbers of the birds surviving the winter are very similar to those, in the next winter, too.

Here is to be mentioned an important problem of the protection of birds. That is the hesitation of some bird species observed at our night and daytime birds of prey, caused by anthronogenic effects. The real causes of that hesitation are the hunters distroying systematically also the useful birds of prey. There are hit by that very hard the wood long-eared owls that in the winter month are staying in packs and are very tame in the daytime,being therefore easy preys for the hunters. This opinion of mine is supported by the fact that while in the winter of 1966/1967 13 wood long-eared owls survived the winter in the old willow plantation, in the winter of 1967/1968 about the same number of them were tumbled down in the same space.

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Kleinsäugerfaunistische Angaben aus dem Hernádbecken auf Grund der Gewölluntersuchungen der Schleiereulen /Tyto alba /Scop.//

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Auszug

Eine der wichtigen Aufgaben der heimischen Zoologie ist, innerhalb der verschiedenen Tiergruppen die Verbreitung der einzelnen Arten der Möglichkeit nach genau klarzustellen und die Punktkarten dementsprechend zu verfertigen. Nur im Besitz dieser grundlegenden Angaben vermögen wir die Bearbeitung der einzelnen Gruppen oder Arten genügend auszuführen.
Die verschiedenen ökologischen Probleme und die der Konzentration der Individuen beruhen natürlich alle auf der genauen Kenntnis der Verbreitungsverhältnisse. In Verbindung mit dieser Aufgabe haben wir die planmässige Stoffsammlung in Hernádtal begonnen. Der Zweck war die Angaben der Kleinsäugetiere zu sammeln. Auf diesem Gebiet haben früher Vásárhelyi /1931/ in der Umgebung von Mêra mit Schlingenstellung, K ö v e s und S c h m i d t /1964/ in Tornyosnémeti mit Hilfe von Eulengewöllen Untersuchungen in dieser Richtung durchgeführt. Es ist schon von Vásárhelyis Angaben nachgewiesen worden, dass in dem breiten Tal von Hernád tiefländische Elemente nach Norden ziehen; und es ist auch durch das Vorkommen von *Spalax leucodon* in der Umgebung von Mêra bestätigt. Da jedoch dieser Fall nicht einmalig ist, wurde von unseren eigenen Untersuchungen bewiesen, als es uns gelungen war, ein seltenes und gleichfalls typisch tiefländisches Nagetier, das Sicista loriger selbst von vier Punkten zu erweisen. Es wurden ausserdem interessante Ergebnisse von den aus quantitativen Gesichtspunkten ausgeführten Vergleichen der mit den *Sorex*- und *Crocidura*-Arten verbundenen Angaben erhalten. Diese Arbeit betrachten wir nicht für beendet und wollen sie fortsetzen, erstreckend sie allenfalls auch auf das Bodrogtal. Unsere neuere Ergebnisse werden wir in der gegebenen Zeit mitteilen.

Einführung

Die faunistische Untersuchung der Klensäuger, besonders die Forschung der miteinander verglichenen quantitativen Verhältnisse der einzelnen Arten, ist in Ungarn ein ziemlich stiefmütterlich behandeltes Wissenschaftsgebiet. Abgesehen von einigen Gruppen, bzw. Arten /z.B. *Chiroptera*, *Microtus arvalis*/, fanden nur lokale, voneinander am meisten unabhängige Untersuchungen solcher Richtung statt, unsere Kenntnisse sind im grossen und ganzen ausserordentlich mangelhaft. Die Arbeit wird auch durch die zweifellose praktische Schwierigkeit der Angabensammlung in mehreren Hinsichten gehindert. Die Mehrzahl der zu untersuchenden Arten hat eine nächtliche Lebenweise. Bei Tag bewegen sie sich überhaupt nicht oder nur sehr wenig und dann auch sind sie in der Vegetation versteckt. So kommt die Beobachtung im Freien, die bei anderen Gruppen, z.B. bei den Vögeln gute Ergebnisse geben mag, gar nicht in Frage. Die einzige zweckmässige Methode ist die Sammlung der verschiedenen Kleinsäugerarten in so grossen Mengen wie möglich. Dies kann mit Fallen geschehen.
Eine gewisse Anzahl der Fallen wird gestellt täglich eine

gewisse Zeit lang in dem zu untersuchenden Gebiet und die gefangenen Einzeltiere gezählt. Diese Methode ist nur wenig geeignet für grossangelegte quantitative Untersuchungen. Sie kann jedoch auch mit der Analyse der Eulengewölle stattfinden. Wir haben für unsere Arbeit diese letztere Methode gewählt.

Die Methode und das untersuchte Gebiet

Wir machen das Wesen der Eulengewöllanalyse als Untersuchungsmethode ganz kurz bekannt. Die Eulen, im Gegensatz zu den Tagesraubtieren, verdauen nicht die Knochen der für ihre Nahrung dienenden Tiere, sondern sie geben diese mit Haaren gemischt in der Form von länglichen Knödeln - Gewöllen - zurück. Die so erhaltenen Schädel und Kiefer können am meisten leicht und genau bestimmt werden. Die qualitativ brauchbarsten Gewölle sind in heimischer Beziehung zweifellos von den Schleiereulen zu erwarten. Diese Art, obzwar sie in Ungarn in den letzten Jahrzenten abnahm, ist überall im Lande noch immer verbreitet und mag ein sehr guter Gegenstand für die kleinsäugerfaunistischen Untersuchungen sein. In Ungarn ist sie teils ein Strichvogel, teils - hauptsächlich in den südlichen Landesteilen - ein ständiger Vogel. Ihr Lager ist zunächst einmal in Kirchentürmen, Dachräumen. Hier können auch ihre Gewölle gesammelt werden. Die Bewegungsintensität der Schleiereule während der Jagd geht im allgemeinen die Grenzen eines Kreises mit 3 km Radius nicht über. Deshalb fällt der Abstammungsort der in den Gewöllen befindlichen Beutetiere notwendigerweise innerhalb dieses gegebenen Gebietes. Sie jagt in der Umgebung der Wohngebiete und in den offenen Kulturgebieten, geht nicht in den Wald. Die aus ihren Gewöllen erhaltenen faunistischen Angaben beziehen sich deshalb immer auf die Kulturstenne. Da wir aus den in einer Sammelstelle gefundenen Gewöllen zugleich eine grössere Menge von Angaben erhalten mögen, die in einer theoretisch entsprechenden Streuung aus dem ganzen Bezirk der Sammelstelle stammen, kann diese Weise der Untersuchung sehr erfolgreich werden. Die Schleiereule ist während ihrer Jagd nicht immer wählerisch und erbeutet die in grösster Menge vor sie geratenen Kleinsäuger in der grössten Anzahl. So können wir aus den Gewöllen auch auf die bestehenden quantitativen Verhältnisse schliessen. Ausserdem bedeutet die Bearbeitung des gesammelten wenn auch grösseren Stoffes eine höchstens einige Tage lang dauernde laboratorische Arbeit. Dies ist hinsichtlich der erhaltenen numerischen Ergebnisse und der Zeitaufwendung aus faunistischem Gesichtspunkt gesehen viel rentabler als die Sammlung mit Fallen, wo nach Anwendung von 100 Fallen es schon meistens für ein sehr gutes Ergebnis gilt, wenn man während einer Nacht 3o-35 Tiere sammeln kann.

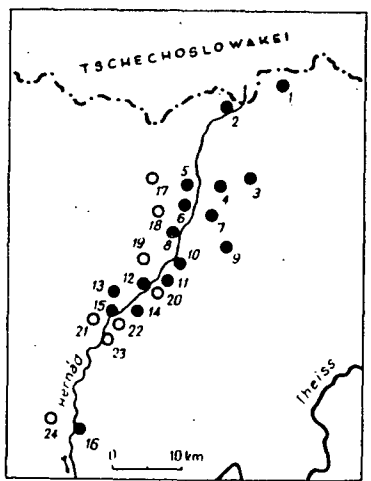

Abb.1.: Sammelstelle der Gewölle im Hernádbecken /schwarzer Ring/, bzw.

die Stellen, wo die Durchforschung der Kirchentürme mit einem negativen Ergebnis schloss /leerer Ring/.
Die Karte zeigt auch die Verbreitung der Schleiereule /Tyto alba/ im Flussbecken.Erklärung der Zahlen: 1: Kéked, 2: Tornyosnémeti, 3: Hejce, 4: Vilmány, 5: Garadna, 6: Novajidrány, 7: Vizsoly, 8: Méra, 9: Boldogkőváralja, 10: Gibárt, 11: Hernádhüd, 12: Hernádszentandrás, 13: Csobád, 14: Felsődobsza, 15: Kiskinizs, 16: Gesztely, 17: Fulókércs, 18: Szalaszend, 19: Forró, 20: Pere, 21: Halmaj, 22: Hernádkércs, 23: Szentistvánbaksa, 24: Onga.

Die Sammlung wurde in 1968-1969 im Hernádbecken in der Strecke von Kéked bis zu Gesztely durchgeführt. Die Plazierung der Fundstellen mag als kontinuierlich betrachtet werden, allein zwischen Kiskinizs und Gesztely gibt es eine Gebietsstrecke, wovon wir keinen Stoff zu sammeln vermochten. Im Laufe der Arbeit haben wir in den einzelnen Gemeinden nur die klassischen Eulennester in den Kirchendachräumen und Türmen für Gewölle durchgesucht. Die Sammelstellen negativen Charakters bedeuten also nicht unbedingt, dass die Schleiereule in der Gemeinde oder in ihrer Umgebung überhaupt nicht vorkommt /Abb.1./ Die Hernád selbst hat in der untersuchten Strecke einen nord-östlichen Ablauf, begrenzt von rechts von dem Cserehát genannten Hügelgelände, von links von dem Zemplén-Gebirge, südlich von dem Hügelgelände zu Harangod. Der Fluss ist in einer wechselnden Breite von einem Überschwemmungswald begleitet, dessen Hauptcharakteristika die verschiedenen Weidenarten sind. Ausserhalb des Überschwemmungsgebiets liegt eine landwirtschaftliche Kulturstepne. Die Gemeinden, wovon der Untersuchungsstoff stammt, liegen in dem engeren und weiterem Sinn genommenen Flussbecken; das Jagdgebiet der Eulen wurde deshalb hier konzentriert. Die Menge des gesammelten Stoffes ändert sich stellenweise; ausser den reicheren Fundstellen sind auch einige, wo wir nur einige Gewölle gefunden haben. Die Ergebnisse waren natürlich unter Rücksichtnahme auf diesem Umstand zu bewerten. Die in den Gewöllen vorkommenden, übringes wenigen, Vogel und Amphibienüberreste haben wir in dem gegenwärtigen Fall ausser Acht gelassen.

Im Hernádbecken, in der Gegend von Méra hatte früher Vásárhelyi /1931/ Säugetiersammlungen durchgeführt und in der Umgebung von Tornyosnémeti wurden mit Benützung von Eulengewöllen kleinsäugerfaunistische Untersuchungen vorgenommen. / K ö v e s - S c h m i d t 1964/.

Ergebnisse

Soricidae

Die Spitzmäuse kommen in den Beutelisten der Schleiereulen immer mit verhältnismässig hohen Werten vor. Die Schleiereule ist die einzige, in freien Gebieten jagende Eulenart in Europa in deren Gewöllen die verschiedenen Kleinsäugerarten in ihrer gegenseitig verhältnismässigen Häufigkeit vorkommen. In diesem Falle haben sie 11,7 % des Säugetiermaterials gebildet. Die Waldspitzmaus /*Sorex araneus* L./ die eine der charakteristischen Arten in den die Flüsse begleitenden Überschwemmungswäldern ist, ist in allen bedeutenden Sammelstellen vorgekommen /Tabl. 1./. Mit einer ähnlichen Verteilung aber im allgemeinen mit einem viel niedrigeren quantitativen Wert kam die Zwergspitzmaus /*Sorex minutus* L./ vor. Es waren jedoch auch zwei interessante Ausnahmen, wo die Zahl des

Sorex minutus sich dem des *Sorex araneus* gegenüber ungewöhnlich stark erhöhte. So in Tornyosnémeti war das gegenseitige Verhältnis der zwei Arten das folgende: *Sorex araneus* 60 %: *Sorex minutus* 40 %. Dasselbe Verhältnis aus dem in Vilmány gesammelten Material war: 56 : 44 %. Im Laufe der Bewertung der Nahrung der Schleiereule, in der Übergangszone der osteuropäischen Laubwälder und der Steppe, war das Verhältnis 10,3 : 1, in dem pannonischen Becken 4,6 : 1 % für den *Sorex araneus* /S c h m i d t , im Druck a/.

Die Wasserspitzmäuse /*Neomys*/ kommen in Ungarn, wie es genau durch die Gewölluntersuchungen nachgewiesen wurde, zunächst in Transdanubien vor. Östlich von der Donau kamen sie in den Gewöllen höchstens in einigen wenigen Stellen und selbst dort nur in einigen Exemplaren vor. Diese Fundstellen, den ökologischen Ansprüchen der Spitzmausgattung entsprechend, lagen in jedem Fall bei Wassern, hauptsächlich bei Flüssen. /S c h m i d t 1969/. Im Laufe der Revision des in den Eulengewöllen vorgekommenen heimatlichen *Neomys*materials ist festgestellt worden, dass in unserem Land hauptsächlich die früher für selten gehaltenen Sumpfspitzmäuse /*Neomys anomalus* C a b r e r a/ vorkommen /S c h m i d t 1969/. Eben deshalb war es nicht überraschend, dass auch in den Gewöllen längs der Hernád diese Art auftrat. Im Laufe der Absonderung auf Grund der Koronoidhöhe haben wir kein Exemplar gefunden, das zu der Grössenordnung der Wasserspitzmaus /*Neomys fodiens* S c h r e b e r/ gehört hätte. Die Zugehörigkeit von 7 Exemplaren konnte nicht sicher festgestellt werden, aber auf Grund ihrer Grösse /4,4 - 4,5 mm/ tendierten auch diese zur Grössenordnung des *Neomys anomalus*. Für Beispiel demonstrieren wir die aus den zwei grössten Sammlungen stammenden *N. anomalus* Koronoidhöhengrössen /nur linke Mandibulae/:

Hernádszentandrás	4,1 mm = 5 St.	Felsődobsza	4,0 mm = 2 St.
	4,2 = 2		4,1 = 3
	4,3 = 1		4,2 = 2
			4,3 = 4

Im Spitzmausmaterial haben die *Crocidurae* dominiert. Abgesehen von einigen unbedeutenden Sammlungen /Kiskinizs, Gesztely/, waren sie überall stark vorherrschend dem *Sorex* genus gegenüber. Laut der Angaben der im Donaubogen ausgeführten ähnlichen Untersuchungen /S c h m i d t - S o m o g y i - S z e n t e n d r e y, Manuskript/ z.B. war in Szentendre und Dunakeszi die *Sorex*gattung /zunächst der *Sorex araneus*/ in überwucht den Spitzmäusen mit weissen Zähnen gegenüber. Die im Vergleich mit der Donau wesentlich schmäleren Überschwemmungswälder der Hernád konnten dementsprechend keine *Sorex*population zustandebringen, die sich auch auf die umliegenden Kulturgebiete bedeutend ausbreiten könnte. Von den Spitzmäusen mit weissen Zähnen, die Sammlung zu Hernádszentandrás ausser Acht lassend, war die Feldspitzmaus /*Crocidura leucodon* /Hermann// überall in Übergewicht der Gartenspitzmaus /*Crocidura suaveolens* /P a l l.// gegenüber. Diese Angaben haben die in der Umgebung von Tornyosnémeti früher erhaltenen Ergebnisse unterstützt, nach welchen in diesem Teil Nord-Ungarns die *Crocidura leucodon* der *Crocidura suaveolens* gegenüber in einer zahlenmässigen Überlegenheit ist /S c h m i d t 1967/. In dem Material längs der Hernád gestaltete sich dieses Verhältnis folgenderweise: *Crocidura leucodon* 72 %: *Crocidura suaveolens* 28 %.

Chiroptera

Die Fledermäuse erscheinen auf der Nahrungsliste der Schleiereule meistens nur als ein kolorierendes Gelegenheitselement. Aus dem Hernádbecken vermochten wir aus den Gewöllen 5 Arten zu erweisen /Tab.1/. V á s á r h e l y i /1931/ erwähnt von der Umgebung von Méra 4 von ihm gesammelte Arten.

Rodentia

Der grösste Teil der Nahrung der heimischen Eulenarten wird immer von den Nagetieren gebildet. Von den in diesem Fall gesammelten 6756 Säugern dominierte, entsprechend dem Charakter des Gebietes und dem Jagdgebiet der Schleiereule, die Feldmaus /*Microtus arvalis* /P a l l.//, 62,1 % des Säugermaterials. Dieses auf den landwirtschaftlichen Gebieten überall häufige Nagetier, eben seiner den übrigen Säugerarten gegenüber bestehenden Dominanz zufolge, bedeutet zugleich auch die Hauptnahrung der Schleiereule. Auf der zweiten Stelle steht die *Apodemus /Sylvaemus/* Gruppe mit 14,1 %. In diesem Falle verursacht leider die genaue Artenbestimmung bei einem aus Gewöllen stammenden Stoff manchmal Schwierigkeiten. Der grösste Teil der vorkommenden Exemplare ist sehr wahrscheinlich Waldmaus /*Apodemus sylvaticus* /L.// gewesen. Die Brandmaus /*Apodemus agrarius* /P a l l.// kam in elf Sammelstellen vor. Die Art war in Méra von V á s á r h e l y i /1931/ in nicht mehr als einem Exemplar gefunden und als eine interessante faunistische Sensation angekündigt. Unseren eigenen Angaben gemäss ist die Brandmaus in dem ganzen Hernádbecken allgemein verbreitet /Abb.2/.

Die grösste Überraschung des bearbeiteten Stoffes ist zweifellos das Vorkommen der Streifenmaus /*Sicista subtilis* /P a l l./ gewesen.

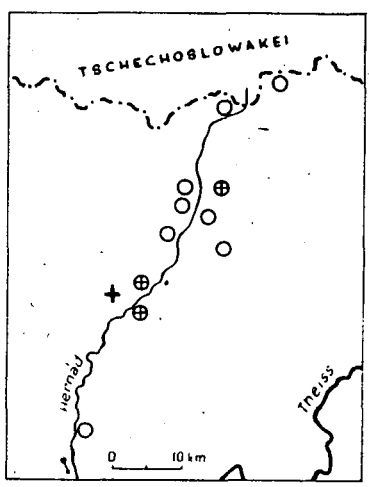

Abb.2. Verbreitung der Streifenmaus /*Sicista subtilis*/ und der Brandmaus /*Apodemus agrarius*/ im Hernádbecken auf Grund von Gewölluntersuchungen. Erklärung der Bezeichnungen: ⊕ = *Sicista subtilis*; ○ = *Apodemus agrarius*; + = gemeinsames Vorkommen.

Diese Art war bis jetzt nur von der ungarischen Tiefebene bekannt, besonders als eine Folge der Tätigkeit von M é h e l y /1913/ und V á s á r h e l y i /1929, 1941/. Die erste Angabe von Transdanubien /T e l k i/ war ebenfalls von den Schleiereulengewöllen geliefert /S c h m i d t, im Druck b/. Im Laufe der jetzigen Untersuchung kam sie in vier Stellen vor. Auf Grund der erhaltenen Angaben scheint es sehr wahrscheinlich zu sein, dass sie in dem ganzen Hernádbecken verbreitet ist und der Sammlung weiterer Gewöllstoffe zufolge noch in zahlreichen Stellen gefunden werden wird. Sie hat sich wahrscheinlich von der Tiefebene in die nördliche Richtung hinaufgezogen und so bekommt in ihrer Verbreitung auch der Fluss eine indirekte aber bedeutende Rolle.

V á s á r h e l y i /1931/ erwähnt den Hamster /*Cricetus cricetus* /L./ als eine seltene Art in der Umgebung von Mêra. Seine Population häuft sich nur in 10-20 Jahren so an, dass er als ein landwirtschaftlicher Schädling bedeutend wird. Die Gewölluntersuchungen erwiesen 14 Exemplare von fünf Stellen. Nachdem der Hamster in der Nahrung der Schleiereule immer nur als eine Gelegenheits-, obzwar nicht eine ausdrücklich seltene Beute vorkommt, schneit die Population in den jüngsten Jahrzehnten stärker geworden zu sein.

Die Kleinwühlmaus /*Pitymys subterraneus* /D e S e l y s L o n g - c h a m p s/, wie es schon aus dem in Tornyosnémeti gesammelten grossen Material zu entnehmen war, ist im Hernádbecken verhältnismässig selten und nur in grösseren Sammlungen kommen einige wenige Exemplare vor /K ó v e s - S c h m i d t 1964/. In Ungarn ist sie hauptsächlich eine Waldart. - Die Zwergmaus ist hingegen allgemein verbreitet /*Micromys minutus* /P a l l./ / Ebenso die Hausmaus /*Mus musculus* L./. Die letztere war von V á s á r h e l y i /1931/ sowohl in ihrer in der Nähe des Menschen lebenden als auch im Ackerfeld vorkommenden Form sammelt. Die ebenso von V á s á r h e l y i als in den Weidengebüschen der Hernád häufig erwähnte Rötelmaus /*Clethrionomys glareolus* /S c h r e b e r// kam nur in einer kleinen Zahl der Gewölle vor, was bedeutet, dass sie nur gelegentlich in die landwirtschaftliche Gebiete oder auf das Weidenland hinauspeht. Ihr Jagdgebiet deckt also dasjenige der Schleiereule praktisch nicht.

Zusammenfassung

Die Verfasser haben die Kleinsäugerfauna des Hernádbeckens mit Hilfe der Schleiereulengewölle untersucht. Ausser der faunistischen Angabensammlung haben sie auch die quantitativen Verhältnisse einiger Arten festgestellt. So dominierten unter den Spitzmäusen *Crocidura leucodon*, unter den Nagetierten *Microtus arvalis* /5,3 bzw. 62,1% des ganzen Säugermaterials/. *Apodemus agrarius* ist im Hernadbecken überall verbreitet. Es ist eine faunistische Neuigkeit, dass *Sicista subtilis* in vier Punkten vorkam. Diese Art war bisher nur von der ungarischen Tiefebene gekannt, nach Nord-Ungarn geriet sie mit der Vermittlung des Flussbeckens.

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Tabl. 1.: Die in den im Hernádbecken gesammelten Schleiereulengewöllen vorgekommenen verschiedenen Kleinsäugerarten

	Kéked	Tornyosnémeti	Hejce	Garadna	Vilmány	Novajidrány	Vizsoly	Méra	Boldogkőváralja	Gibárt	Hernádbűd	Hernádszentandrás	Csobád	Felsődobsza	Kiskinizs	Gesztely	Summe	%
Sorex araneus	2	77	3	6	20	12	-	17	-	-	-	30	-	3	2	-	172	2,6
Sorex minutus	-	51	-	1	16	4	-	3	-	1	-	7	-	3	-	2	88	1,3
Neomys anomalus	-	8	-	-	-	-	-	-	-	-	-	8	-	12	-	-	28	0,4
Neomys indet.	-	-	1	-	-	1	-	3	-	-	-	1	-	1	-	-	7	0,1
Crocidura suaveolens	1	41	1	-	18	19	-	15	-	-	-	37	2	3	-	1	138	2,0
Crocidura leucodon	3	185	13	7	47	43	1	25	2	-	-	19	8	6	1	-	360	5,3
Myotis emarginatus	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0,0
Myotis oxygnathus	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	2	0,0
Plecotus austriacus	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0,0
Nyctalus noctula	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0,0
Eptesicus serotinus	-	1	-	-	-	2	1	-	-	-	-	-	2	-	-	1	7	0,1
Lepus-Oryctolagus	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	2	0,0
Sicista subtilis	-	-	-	-	2	-	-	-	-	-	-	1	2	4	-	-	9	0,1
Muscardinus avellanarius	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0,0
Cricetus cricetus	-	1	-	-	5	-	-	-	1	-	-	4	-	3	-	-	14	0,2
Clethrionomys glareolus	1	4	-	-	7	-	-	-	-	-	-	-	-	-	-	-	12	0,2
Arvicola terrestris	-	-	-	-	2	-	-	-	-	-	-	6	-	3	-	-	11	0,2
Pitymys subterraneus	1	9	1	-	7	-	-	-	1	-	-	-	-	1	-	-	20	0,3
Microtus arvalis	36	2501	17	8	483	167	18	185	2	10	13	433	194	89	22	20	4198	62,1
Micromys minutus	1	81	1	2	9	7	3	17	-	2	1	22	1	2	-	-	149	2,2
Apodemus /Sylvaemus/ indet.	18	440	10	2	177	67	1	43	3	7	3	110	28	23	5	17	954	14,1
Apodemus agrarius	10	59	-	1	38	3	1	3	1	-	-	7	-	2	-	2	127	1,9
Mus musculus	5	96	1	4	55	20	1	22	-	3	5	129	17	40	3	49	450	6,7
Rattus indet.	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0,0
Mustela nivalis	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2	0,0

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Effect of the waste-water of sogar-works on natural history of the river Zagyva

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Abstract

The present paper is analysing the chemical composition and natural history of the river Zagyva, as well as their change as a result of various waste-waters. It is establishing that the effect of the standing pollution depends upon the water output, while the influence of periodical pollutions /waste-water waves/ depends first of all upon the storage time of waste-water.

About the natural history of the river Zagyva there have been issued so far but a few scientific publications, only the monographs of S z e m e s /1940, 1947, 1948/ and U h e r k o v i c h /1966 a, 1968/ being known. Water-chemical data were published by S c h i k /1933/ and P a p p /1961/. The chemical and recently the biological state of its water is followed with attention systematically by organs of water conservancy, owing to the practical importance of the question / G u l y á s 1964, H a m a r 1967/. The utilization of water of the 180 km long Zagyva is manifold; irrigation, industrial water drawing, well-drain and inland water drainage. Its water output is changing /310-0,2 m^3/sec./, depending mostly on the water output of streams flowing into it. The industrial waste-waters are the most important ones of the permanent sources of pollution. The galvanizing, oleiferous, tar-waters of the industrial works in Salgotarján, Hatvan and Jászbereny are spelling a grave loading on the Zagyva. /Fig.1/, mainly because of being toxic and hardly dissociable. The seasonal industrial pollutions are caused by the waste-water of the sugar-works in Selyp and Hatvan. The effect of the waste-waters pouring into it continually depends, in fact, on the water output of the Zagyva, and the waste-waters pouring into it seasonally are superposed upon that basic loading.

Materials and methods

Our laboratory performs water-quality investigations in five sample areas a month, investigating the whole polluted section in the time of waste-water waves. The analysis was carried out by means of samples obtained by drawing and netting. The chemical investigations were carried out whith COMECON-methods, the basic biological qualification with P a n t l e B u c k's /1955/ method / $S = \frac{\Sigma s.h}{\Sigma h}$ /.

The figure of frequency /1-3-5/ was established by estimation. It is demonstrated by practice that P a n t l e - B u c k's formula can generally be used for detecting pollutions in case of river Zagyva. For determining *Protozoa*, mainly we have applied vital staining. The determination of organisms was carried out from the fundamental works of H o r t o b á g y i, H u b e r - P e s t a l o z z i, K a h l, P a s c h e r, S l á d e c e k and U h e r k o v i c h..

Results

The water of the river Zagyva is of medium hardness, the dominance of ions Ca^{++}, Mg^{++}, So_4^{--}, HCo_3^- is characteristic of it, the content of the total dissolved matter in it is changing /400-1300 mg/l/. Its chemical composition is influenced by its state of pollution /Table 1/. It is characteristic of the state of water quality in the Zagyva, besides the waste-water waves, that it is made poly-α-mezosaprobical by the stream Tarján flowing into it at its upper reaches and carrying the industrial and house waste-waters of Salgótarján. But in the most polluted state the water was antisaprobical. The β-mezosaprobical water of the Zagyva reaches above Hatvan is, as a result of the waste-waters of the town, again polluted /polysaprobical/. Until Jászbérény it becomes considerably clearer /β-mezosaprobical/, the waste-waters of the town exert their effect but on a short section. On the lower reaches between Jászbérény and Szolnok there is no major waste-water influence. We found the biologically clearest picture at inundations. The biological state of the lower reaches is influenced strongly by the damming effect of the river Tisza. In case of law water the pollution is stronger /Table III, 8/.

From the microorganisms the algae are dominating, mainly the diatoms whose composition changes depending upon the character of reaches and the degree of pollution /Table II, III/. *Chlorophyceae* appear in higher number in the vegetation period, *Euglenophyta* at a higher degree of pollution.

According to our observations, *Cyanophyta* increase at law water, in warm weather, mainly those indicating a strong pollution /Table III, 8/.

The state of water quality of the river Zagyva is the most homogeneous in the season of waste-water waves. The storage tank of the sugar-works in Selyp had a capacity of 6500 m^3 in 1965, 168.000 m^3 in 1967, the former one with a storing time of 8-10 days, the latter with that of 20-21 days. The waste-waters of a short storing period like that are at the beginning of the processes of anaerobic dissolution. They contain much organic matter and floating sediment, their BOD. is 90-400 mg/l. Apart from bacteria -among them streptococci- only flagellatae can be found in them./Table II, 2/ The amount of the waste-water emitted is about 1 m^3/sec., corresponding to the water output of the Zagyva. Later on, that water becomes diluted but its quality is hardly changing. At that time, the water of the Zagyva becomes stinking, of black colour, strongly reductive /Table I. 3/.

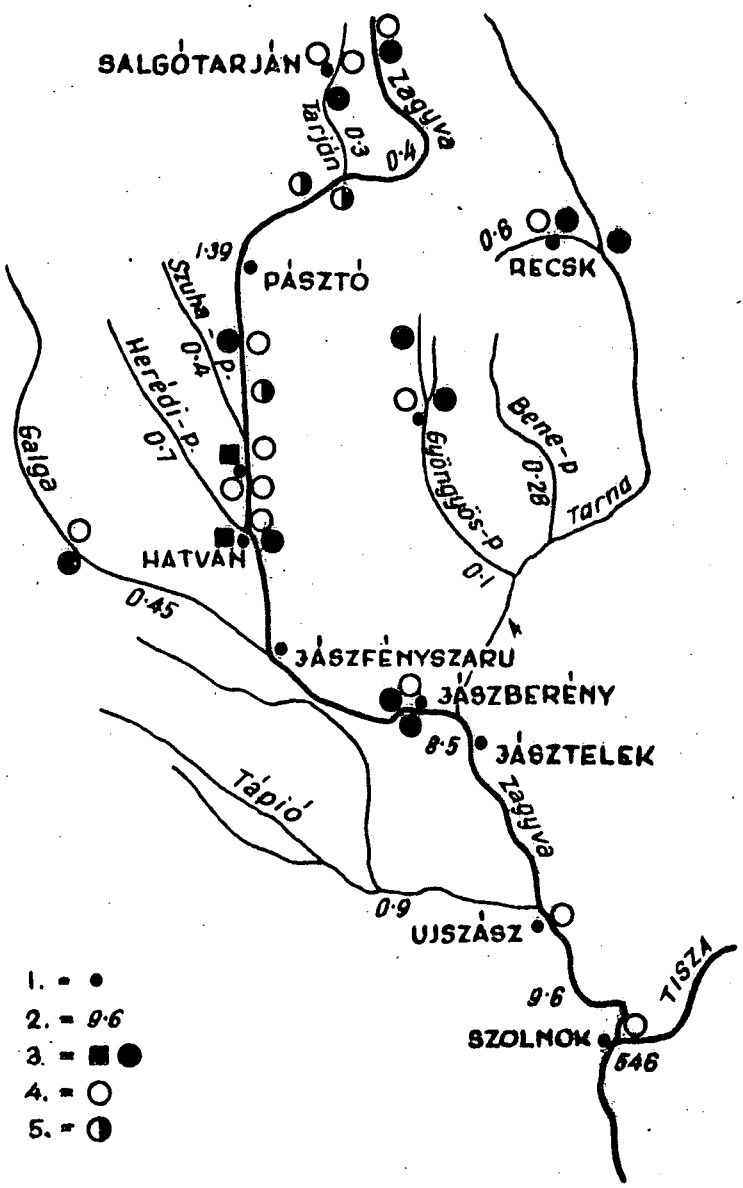

Fig. 1. Waste-water sources of the river Zagyva

Legend; 1. Settlement , 2. Mean water output , 3. Industrial waste-water , 4. House waste-water , 5. Industrial and house waste-water.

The biological qualification has demonstrated only little change in the longitudinal section of the river Zagyva. *Nitzschia palea* that appears in the lower reaches is demostrating that some change took place in the quality of water /Table II, 3-7/. At the mouth of river, the effect of the waste-water wave can be observed well /Fig. 2/. The pollution of that degree turns the Zagyva into a sewer, extreninating almost fully its natural fauna and flora and making its influence feel even after the waste-water wave had passed. According to the data of fishery, in campaign of sugar-works each, there perish about 2-300 q /cca. 4-600 cwt/ fish, for the most part carp, bream, and catfish.

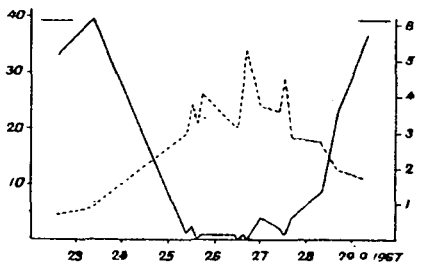

Fig. 2. Change in the oxygen management at mouth of the river Zagyva, as a result of waste-water from the sugar-works in Selyp.

Legend; _____ dissolved O_2 mg/1 , _ _ _ _ O_2 decrease mg/1

Things are not the same in case of the sugar-works in Hatvan. This factory has a storage tank of 550.000 m^3. It pours its waste-water into the river Zagyva after finishing the period of its campaign, at high water. The waste-water itself, too, is in a more advanced state of self-purification than that of the sugar-works in Selyp. In addition to *Bacteria*, there are in its water *Protozoa* and *Algae*, as well. Owing to the stronger dilution, this waste-water can become clear in the Zagyva, being indicated there by the discolouration of the water, too. It rather increases the nutriment content of the river and passes without any major damage /Table III, 4-6/.

A specialist, after surveying the list of taxons, can ascertain how variegated the microflora and fauna of the river Zagyva /between Selyp and Szolnok/ is. It will be the task of further investigations to reveal the causes and regularities of the changes in the natural history.

The microorganisms of the river Zagyva /Selyp - Szolnok/:

Schizomycetes

1. *Beggiatoa alba* Trevisan
2. *Coccus*
3.

3. *Filamentous bac.*, in the time of the waste-water waves of the sugar-works and canning factory there was in the water a large amount of characteristic, long / 100-200 µ/ bacteria.
4. *Sarcina palludosa* S c h r o e t e r
5. *Spaerotilus natans* K ü t z ., being observed in the neighbourhood of sewage pipes of the sugar-works and at low water near to the mouth, as well /Table II, 8/, with thalluses both in the plankton and benthos equally.
6. *Spirillum undulans* E h r .
7. *Spirillum* spp.
8. *Streptococcus margaritaceus* S c h r o e t e r
9. *Thiotrix nivea* / R a b. / W i n o g.
10. *Thiovolum* sp.
11. *Zoogloea ramigera* I t z i g.

C y a n o p h y t a

12. *Achronema articulatum* S k u j a, its trichom being straight or somewhat curved, the cells strongly laced. The granules of protoplasm are denser in the longitudinal axis of the cell, in the middle of it. Cell sizes; 8,3 - 10 x 2,5 µ/ Fig. 3, 13/.
13. *Coelosphaerium kutzingianum* N ä g.
14. *Coelosphaerium pusillum* v a n G o o r
15. *Merismopedia elegans* A. B r .
16. *Merismopedia minima* G. B o c k
17. *Merismopedia tenuissima* L e m m
18. *Microcystis aeruginosa* K ü t z
19. *Oscillatoria amphibia* A g .
20. *Oscillatoria chlaybea* M r t .
21. *Oscillatoria chlorina* K ü t z.
22. *Oscillatoria granulata* G a r d .
23. *Oscillatoria lauterbornii* A g., the trichom of green colour is straight or mildly curved, the 2,5 µ wide and 3,3 - 5 µ long cells at the cross-wall are not laced. In the middle of cell 1-3 gas vacuoles of irregular shape can be observed /Fig. 3, 8/. It can be found in a highly polluted water, first of all associated with *Beggiatoa alba* and *Oscillatoria chlorina*.
24. *Oscillatoria limosa* A g.

25. *Oscillatoria pseudogeminata* G. Schmid
26. *Oscillatoria putrida* Schmidle
27. *Oscillatoria tenuis* Ag.

Chrysophyta - Chrysophyceae

28. *Dinobryon divergens* Imhof
29. *Synura uvella* Ehr

Chrysophyta - Bacillariophyceae

30. *Achnantes lanceolata* / Breb./ Grun.
31. *Achnantes microcephala* Kütz.
32. *Achnantes minutissima* Kütz.
33. *Amphora ovalis* Kütz.
34. *Caloneis amphisbaena* / Bory / Cl.
35. *Cocconeis placentula* Ehr.
36. *Cocconeis placentula* var *euglypta* / Ehr./ Cl.
37. *Cymatopleura elliptica* / Bréb. / W. Smith
38. *Cymatopleura solea* / Bréb. / W. Smith
39. *Cymatopleura solea* var. *regula* / Ehr, / Grun
40. *Cymbella ventricosa* Kütz.
41. *Diatoma elongatum* /Lyngb./ Ag.
42. *Diatoma vulgare* Bory
43. *Fragillaria capucina* Desm.
44. *Fragillaria crotonensis* Kitt.
45. *Gomphonema constrictum* Kütz.
46. *Gomphonema olivaceum* / Lyngb./ Kütz.
47. *Gomphonema parvulum* / Kütz./ Grun.
48. *Gyrosigma attenuatum* / Kütz./ Rabh.
49. *Hantzschia amphioxys* / Ehr./ Grun.
50. *Melosira granulata* / Ehr./ Ralfs.
51. *Melosira granulata* var. *angustissima* /O. Müll / Hust.
52. *Melosiara varians* Ag.
53. *Navicula cryptocephala* Kütz.
54. *Navicula hungarica* Grun.

55. *Navicula pygmea* K ü t z .

56. *Navicula rhynhocephala* K ü t z .

57. *Navicula viridula* K ü t z .

58. *Nitzschia acicularis* W. S m i t h .

59. *Nitzschia capitellata* H u s t .

60. *Nitzschia closterium* / E h r./ W. S m.

61. *Nitzschia gracilis* H a n t z s c h .

62. *Nitzschia linealis* W. S m i t h .

63. *Nitzschia palea* / K ü t z / W. S m i t h .

64. *Nitzschia sigmoidea* / E h r./ W. S m i t h .

65. *Nitzschia tryblioella* H a n t z s c h .

66. *Rhoicosphenia curvata* / K ü t z ./ G r u n .

67. *Stephanodiscus hantzschii* G r u n .

68. *Suriella robusta* var. *splendida* / E h r./ V. H.

69. *Suriella ovata* K ü t z./

70. *Suriella ovalis* B r é b .

71. *Synedra acus* K ü t z .

72. *Synedra affinis* K ü t z .

73. *Synedra ulna* / N i t z s./ E h r .

C h r y s o p h y t a - X a n t o p h y c e a e

74. *Tribonema vulgare* P a s c h ., caused water-colouration in the protruded branches of the river; in its bed I did not find it /July 11th 1969/.

E u g l e n o p h y t a

75. *Anisonema acinus* D u j .

76. *Astasia klebsii* L e m m .

77. *Euglena acus* E h r .

78. *Euglena intermedia* S c h m i t z .

79. *Euglena polymorpha* D a n g .

80. *Euglena proxima* D a n g .

81. *Euglena oxyuris* f.*minor* D e f l .

82. *Euglena tripteris* / D u j./ K l e b s .

83. *Euglena viridis* E h r .

84. *Lepocynclis ovum* / E h r./ M i n k .

85. *Phacus curvicauda* S v i r .

86. *Phacus longicauda* / E h r./ D u j .

87. *Phacus pleuronectes* /O. F. M./ D u j .

88. *Phacus wetsteinii* D r e z .

89. *Peranema trichophorum* C h e n .

90. *Menoidium falcatum* Z a c h a r .

91. *Trachaelomonas acuminata* / S c h m a r d a / S t e i n

92. *Trachaelomonas fluviatilis* L e m m .

93. *Trachaelomonas granulosa* P l a y f .

94. *Trachaelomonas hispida* /P e r t y/ S t e i n

95. *Trachaelomonas intermedia* D a n g .

96. *Trachaelomonas scabra* P l a y f .

97. *Trachaelomonas volvocina* E h r .

98. *Trachaelomonas volvocina* var. *granulosa* P l a y f .

C h l o r o p h y t a - C h l o r o p h y c e a e

99. *Actinastrum hantzschii* L a g e r h .

100. *Ankistrodesmus falcatus* var. *acicularis* /A.B r./ W e s t

101. *Ankistrodesmus falcatus* var. *mirabile* W. et. W.

102. *Ankistrodesmus falcatus* var. *spirilliformis* G. S. W e s t

103. *Ankistrodesmus longissimus* W i l l e

104. *Ankistrodesmus setigerus* /S c h o e r e d/ G.S. W e s t

105. *Chlamydomonas ehrenbergii* G o r .

106. *Chlamydomonas pertusa* C h o d .

107. *Chlamydomonas simplex* P a s c h e r .

108. *Chlorella vulgaris* B e i j .

109. *Chodatella balatonica* S c h e r f f e l

110. *Chodatella ciliata* L e m m., on the poles of the ellipsoidal cell thin, curved shikes are sitting. Size of cell; 11,6 x 8.3 µ the length of spikes being 9,2 - 10,8 µ /Fig. 3,2/.

111. *Chodatella longiseta* L e m m., the length of cell is 1o,8 µ, its width 8,3 µ, the length of curved spikes being 33-37,5 µ /Fig. 3,1/

112. *Chodatella quadriseta* L e m m .

113. *Cladophora glomerata* K ü t z ., a plant characteristic of the benthos and perifiton of the river Zagyva. It has a wide ecological valence being present, according to S l á d e č e k /1962/, from the clear /oligosaprobical/ waters to the polluted /mezosaprobical/ ones. C h u d y b a /1965/ describes them from a river and streams of clear water /1968/, distinguishing two characteristic groups; *Cladophora* glomerata rheobenticum occours in flowing places, while *Cladophora glomerata limnobenthicum* in places without any flow. F j e r d i n g s t a d /1950, 1967/ is characterizing with the *Cladophora* community a saprobical zone. Being a sessile organism, epifitic community develop on it - mainly diatom - described *Chudyba* /1968/ under the name of *Cladophoretum glomeratae epiphytosum rheobenthicum* C h u d y b a . An estimation of the *Chladophora* community in the river Zagyva would be reasonable even from saprobiological point of view. According to my observations, the change in pollution is well-indicated by the epifitic community on the *Cladophora*. At the passing of waste-water waves, on the *Cladophora*, *Beggiatoa alba* and *Zoogloea ramigera* settled and the frequency of *Nitzschia palea* a *Nitzschia acicularis* increased. As the pollution had ceased being, the original community reappeared.

114. *Coelastrum microporum* N ä g .

115. *Crucigenia quadrata* var. *octogona* S c h m i d l e .

116. *Crucigenia rectangularis* G a y .

117. *Crucigenia tetradedia* / K i r c h . / W. et W.

118. *Dictyosphaerium elegans* B a c h .

119. *Dictyosphaerium pulchellum* W o o d .

120. *Eudorina elegans* E h r .

121. *Gonium pectorale* E h r .

122. *Gonium sociale* W a r m .

123. *Lagermeimia wratislaviensis* S c h o e r e d , the spikes of widened basis found on the poles and on both sides of the ellipsoidal cell lie in one level. Cell size; 6-8 x 4-5 µ, the spikes being 13-15 µ long /Fig. 3, 12/.

124. *Lambertia ocellata* var. *maxima* U h e r k o v., the cell of size 140 x 14 µ is elongated spindle-shaped, narrowing at both ends /Fig. 3, 18/.

125. *Micractinium pusillum* F r e s .

126. *Oocystis lacustris* C h o d .

127. *Oocystis crassa* var. *marssonii* P r i n t z

128. *Pandorina morum* / M ü l l / B o r y .

129. *Pediastrum boryanum* M e y e n

130. *Pediastrum duplex* M e y e n

131. *Pediastrum duplex* f. *setigera* K o r s c h., on the peaks of the outer cells there are sitting two-three thin spikes of 5-14 µ length /Fig. 3, 16/

132. *Scenedesmus acuminatus* /L a g e r h ./ C h o d .

133. *Scenedesmus acutus* M e y e n

134. *Scenedesmus anomalus* / G. M. S m i t h / T i f f., cell size; 6-8 x 1,7 µ, spike 7,5-10 µ /Fig. 3, 4-5/.

135. *Scenedesmus anomalus* /G. M. S m i t h/ T i f f . varians?, the cells forming coenobium in pairs, bending outwards. Size cell; 10 x 1,7 µ, spike 9-10 µ /Fig. 3, 3/.

136. *Scenedesmus anomalus* /G. M. S m i t h/ T i f f . forma? on the ends of cells of size; 8,3 x 1,7 µ a short spike of 3-3,5 µ is sitting /Fig. 3, 6/.

137. *Scenedesmus bicaudatus* /H a n g s ./ C h o d .

138. *Scenedesmus denticulatus* L a g e r h .

139. *Scenedesmus ecornis* /R a l f s./ C h o d .

140. *Scenedesmus ellipsoideus* C h o d .

141. *Scenedesmus granulatus* W. et W.

142. *Scenedesmus intermedius* C h o d .

143. *Scenedesmus intermedius* var. *balatonicus* H o r t o b .

144. *Scenedesmus intermedius* var. *bicaudatus* H o r t o b .

145. *Scenedesmus nanus* C h o d . , cell size; 7,5 x 5 µ, spike /Fig. 3, 10/.

146. *Scenedesmus opoliensis* P. R i c h t .

147. *Scenedesmus protuberans* F r i t s c h .

148. *Scenedesmus quadricauda* /T u r p ./ B r é b./

149. *Scenedesmus quadricauda* var. *setosus* K i r c h . /Syn; Sc. *longus* M e y e n , Sc. *longus* var. *nägelii* / B r é b./

G. M. S m i t h, *Sc. nägelii* B r é b./, the coenobium consists of 4-8 cells, the cells being spindle-shaped, their ends bluntly peaked or rounded. On the poles of inner cells a straight or somewhat curved spike of chaning length is sitting. Cell size: 6,7-10 x 2,5-5 μ, the length of spikes being 5-10 μ. The specimens found by me /Fig. 3, 9, 11, 14, 15/ can be classed into the form-circle of *Sc. quadricauda* var. *setosus* K i r c h., if we consider the taxons of *Sc. longus*, *Sc. longus* var. *nägelii*, *Sc. nägelii* - those their specimens where the inner cells are spiky, as well, - to be synonymic.

150. *Sc. spinosus* C h o d .

151. *Selenastrum gracile* R e i n s c h

152. *Sphaerellopsis gleocystiformis* /D i l l/ G e r l o f f, Cell size; 12 x 9 μ together with cell-membrane; 20 x 18, the flagellum being 21 μ long /Fig. 3, 17/.

153. *Spondylomorum quarternarium* E h r .

154. *Tetraedron minimum* /A. B r./ H a n s g .

155. *Tetraedron muticum* /A. B r./ H a n s g .

156. *Tetraedron glabrum* / R o l l / A h l . et T i f f .

157. *Tetrastrum staurogenieforme* /S c h o e r e d / L e m m .

C h l o r o p h y t a - C o n j u g a t o p h y c e a e

158. *Closterium acerosum* E h r .

159. *Closterium strigosum* B r é b .

160. *Spirogyra* sp.

161. *Staurastrum paradoxum* M e y e n

Z o o f l a g e l l a t a

162. *Bodo globosus* S t e i n

163. *Bodo mutabilis* K l e b s

164. *Bodo putrinus* L e m m .

165. *Bodo repens* K l e b s.

166. *Bodo saltans* E h r .

167. *Cercobodo agilis* /M o r o f f/ L e m m .

168. *Cercobodo longicauda* /S t e i n/ S e n n

169. *Desmarella moniliformis* K e n t .

170. *Hexamitus inflatus* D u j .
171. *Hexamitus pusillus* K l e b s .
172. *Monas vulgaris* /C i e n./ S e n n
173. *Oicomonas sociabilis* K e n t
174. *Tetramitus pyriformis* K l e b s
175. *Trepomonas agilis* D u j .
176. *Trepomonas rotans* K l e b s
177. *Trepomonas steinii* K l e b s
178. *Trigonomonas compressa* K l e b s

R h i z o p o d a

179. *Actinophris sol* E h r .
180. *Actinosphaerium echicornii* E h r .
181. *Amoeba radiosa* D u j .
182. *Arcella vulgaris* E h r .

C i l i a t a

183. *Aspidisca costata* C l . e t L a c h .
184. *Carhesium* sp.
185. *Chilodonella cucullulus* O.F. M ü l l .
186. *Chilodonella uncinata* E h r .
187. *Chinetochilum margaritaceum* P e t r y .
188. *Coleps hirtus* N i t z s.
189. *Colpidium colpoda* S t e i n
190. *Cyclidium citrulus* C h o n
191. *Dileptus anser*. O. F. M ü l l .
192. *Euplotes charon* S t e i n
193. *Glaucoma scintillans* E h r .
194. *Halteria grandinella* E h r .
195. *Holophrya nigricans* L a u t e r .
196. *Lionotus fasciola* E h r .
197. *Loxophyllum helus* S t o k .
198. *Metopus es* C l . et L o c h .
199. *Metopus contortus* L e v . ?
200. *Oxytricha fallax* S t e i n ?
201. *Paramaecium* sp.
202. *Pleuronema crassum* D u j . ?
203. *Plagyophylla nasuta* S t e i n
204. *Prorodon terres* E h r .
205. *Spirostomum ambiguum* E h r .
206. *Stentor polymorphus* E h r . - S t e i n
207. *Stylonichia mytilus* E h r . ?
208. *Tachiosoma pellionella* M ü l l . - S t e i n

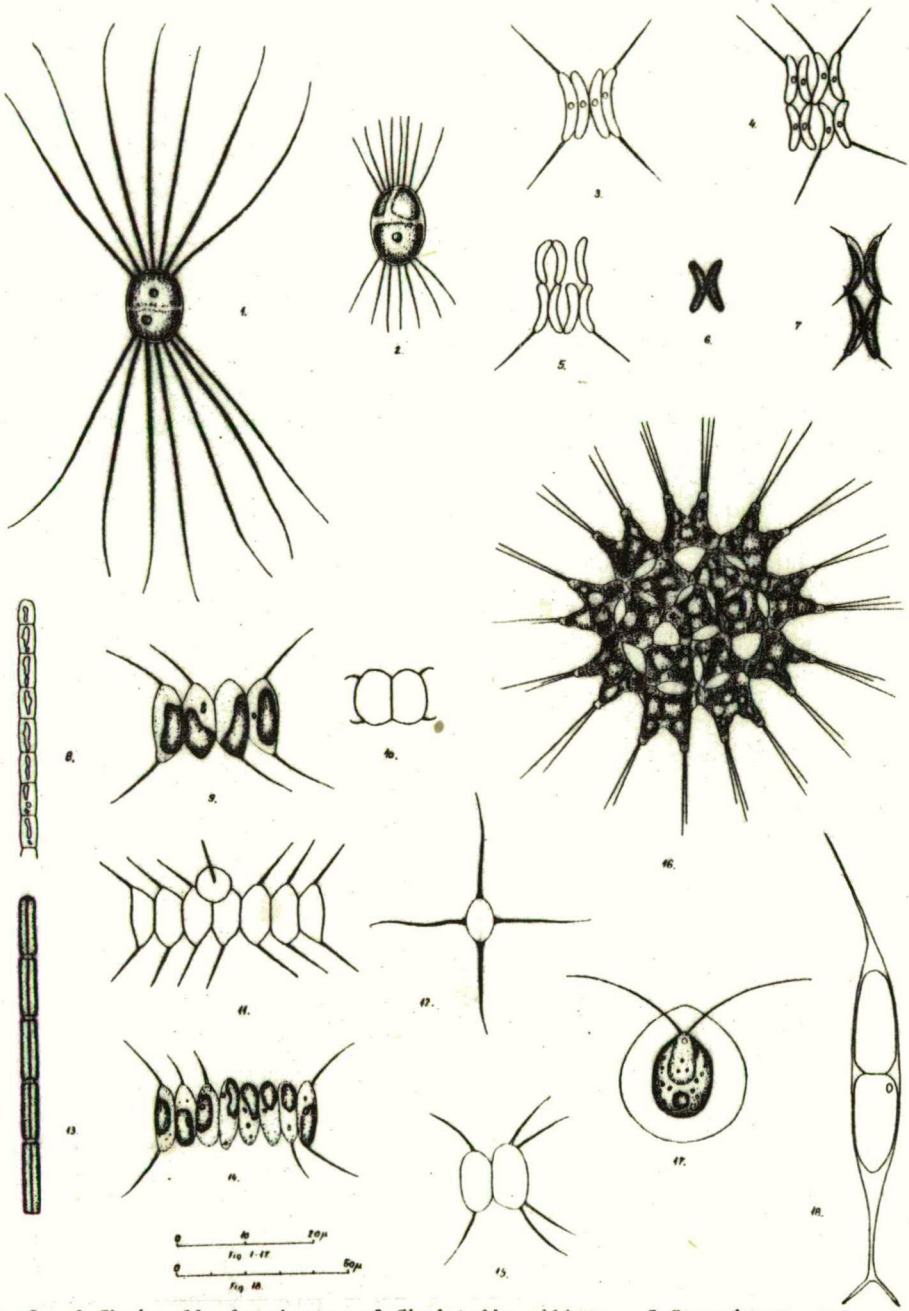

Fig.3. 1.Chodatella longiseta , 2.Chodatella ciliata , 3.Scenedesmus anomalus forma , 4.5.Scenedesmus anomalus , 6.Scenedesmus anomalus var. acaudatus , 7.Scenedesmus anomalus forma , 8.Oscillatoria lauterbornii , 9.11.14.15.Scenedesmus quadricauda var. setosus , 10.Scenedesmus nanus , 12.Lagerheimia wratislaviensis , 13.Achronema articulatum , 16.Pediastrum duplex f. setigera , 17.Sphaerellopsis gleocystiformis , 18.Lambertia ocellata var. maxima

209. *Urostyla* sp.
210. *Uronema marinum* Duj.
211. *Vorticella campanula* Ehr.
212. *Vorticella convallaria* Noland

Summary

The defence of our natural water supply belongs to our first-class tasks. By increasing the sources of pollution, the ability of purification in our waters decreases. That is meaning a problem, mainly in case of receivers of a small and changing water output like the river Zagyva is. The change in the degree of pollution engendered by the several and continuous waste-water intakes depends first of all on the water outnut of the river Zagyva. The major pollutions are caused by the seasonal waste-water disposals of the sugar-works. With chemical and biological investigations we have followed with attention the effect of the waste-water of the sugar-works on the Zagyva and found a considerable difference between the effects of the waste-water waves of the two sugar-works, caused by the different storing periods. We have reffered with a few representative examples to the chemical and biological state of the river Zagyva.

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	pH	Alkal. w^o	Ca^{++} mg/l	Mg^{++} mg/l	Na^{+} mg/l	K^{+} mg/l	Cl^{-} mg/l	So_4^{--} mg/l	HCo_3^{-} mg/l	Po_4^{---} mg/l	NH_4^{+} mg/l	No_2^{-} mg/l	No_3^{-} mg/l	O_2 decrease mg/l	Diss.O_2 mg/l	BOD 5 days mg/l	Co_3^{--} mg/l	Free Co_2 mg/l	H_2S mg/l	Biol.
1. Pure	7.3	7.2	107	51,1	71,5	14,7	55,0	209	439	0,67	Ø	0,03	10,3	2,04	14,0	5,92	Ø	0,96	Ø	β-α
2. Polluted	8,5	7,6	93,8	84,1	76,0	34,0	71,1	265	463	2,00	0,3	Ø	6,3	5,24	7,36	8,74	24,0	Ø	Ø	α
3. Strongly polluted	8,1	11	112	52,0	90,0	20,5	46,1	129	671	0,67	5,1	0,03	0,76	62,4	Ø	116,5	6,oo	Ø	trace	p

Table 1. Various pollution of the river Zagyva

Legend: 1. Jászfényszaru Apr. 24 1968
2. Jászfényszaru Apr. 30 1968
3. Jászfényszaru Sept.20 1967

Table 2. Biological evaluation of the waste-water wave from the sugar-works in Selyp

Sample areas November 2nd 1967		1. The Zagyva below Selyp		2. Storage pond of the sugar-works in Selyp		3. The Zagyva at Jászfényszaru		4. The Zagyva at Jászberény		5. The Zagyva at Jásztelek		6. The Zagyva at Ujszász		7. The Zagyva at Szolnok	
Microorganisms	s	h	s.h	h	sh	h	s.h	h	s.h	h	s.h	h	s.h	h	s.h
Coccus	4			5	20	5	20	5	20	5	20	5	20	5	20
Streptococcus margaritaceus	4			3	12										
Filamentous bac.	4			5	20	3	12	5	20	5	20	5	20	5	20
Zoogloea ramigera	4									3	12	3	12	3	12
Beggiatoa alba	4							3	12	5	20	5	20	5	20
Oscillatoria chlaybea	3									3	9	3	9	3	9
Euglena viridis	4			3	12										
Melosira varians	2	3	6												
Synedra ulna	2	5	10												
Achnantes minutissima	2	3	6												
Nitzschia palea	3,5											5	17,5	5	17,5
Anthophysa vegetans	3,5							3	10,5	3	10,5	3	10,5	3	10,5
Bodo putrinus	4			1	4	3	12								
Bodo saltans	3	1	3												
Cercobodo longicauda	4			5	20			5	20	5	20	5	20	5	20
Oicomonas sociabilis	4			3	12	5	20	5	20	5	20	5	20	5	20
Aspidisca costata	2	3	6												
Glaucoma scintillans	3,5	1	3,5												
Σ		17	34,5	25	100	16	64	26	102,5	32	123,5	37	141	37	141
S		2,0		4,0		4,0		3,9		3,85		3,8		3,8	
Biological evaluation		β		p		p		p		p		p		p	

Table 3. Biological evaluation of the waste-water wave from the sugar-works in Hatvan.

Sample areas April 30th 1968		1. Zagyva at Hatvan		2. Storage pond of the sugar-works in Hatvan		3. Zagyva below the sugar-works		4. Zagyva at Jászfényszaru		5. Zagyva at Jásztelek		6. Zagyva at Ujszász		7. Zagyva at Szolnok		8. Zagyva at Szolnok March 29th 1969	
Microorganisms	s	h	s.h	h	s.h	h	s.h	h	s.h	h	s.h	h	s.h	h	s.h	h	s.h
Coccus	4			3	12	3	12	3	12							3	12
Filamentous bac.	4			3	12	3	12	3	12							3	12
Zoogloea ramigera	4			1	4												
Sphaerotilus natans	4															1	4
Beggiatoa alba	4			3	12											3	12
Thiovolum sp.	4			1	4	1	4										
Oscillatoria chlorina	3,5			1	3,5	3	10,5										
Oscillatoria lauterbornii	4															1	4
Euglena proxima	2	1	2							3	6	1	2				
Peranema trichophorum	3			1	3	1	3										
Cyclotella meneghiniana	2	1	2							1	2	3	6	5	10	1	2
Melosira granulata	2							1	2					1	2		
Synedra ulna	2	1	2					1	2	1	2	1	2	1	2		
Navicula cryptocephala	2,5							3	7,5							1	2,5
Nitzschia acicularis	2,5	3	7,5			1	2,5	5	12,5	5	12,5	5	12,5	3	7,5		
Nitzschia palea	3,5	3	10,5	3	10,5	3	10,5	3	10,5	3	10,5	1	3,5	1	3,5	3	10,5
Nitzschia sigmoidea	2,5							1	2,5	1	2,5	1	2,5				
Nitzschia tryblionella	2									1	2			3	6		
Cymatopleura solea	2	1	2							1	2						
Eudorina elegans	2,5									1	2,5	1	2,5	1	2,5		
Pediastrum duplex	2													1	2		
Richteriella botryoides	2							1	2	3	6	3	6	5	10		
Ankistrodesmus falcatus	2	1	2					1	2	3	6	3	6	3	6		
Actinastrum hantzschii	2	1	2					1	2	3	6	5	10	5	10		
Scenedesmus acuminatus	2	1	2									1	2	1	2		
Scenedesmus quadricauda	2	1	2					1	2	1	2	3	6	3	6		
Cercibodo longicauda	4			1	4												
Monas vulgaris	3,5											1	3,5				
Oicomonas sociabilis	4					3	12	3	12								
Anthophysa vegetans	3,5					1	3,5										
Bodo globosus	3	3	9			1	3										
Bodo putrinus	3			1	3	1	3										

Sample areas April 30th 1968		1. Zagyva at Hatvan		2. Storage pond of the sugar-works in Hatvan		3. Zagyva below the sugar-works		4. Zagyva at Jász-fényszaru		5. Zagyva at Jász-telek		6. Zagyva at Uj-szász		7. Zagyva at Szolnok		8. Zagyva at Szolnok March 29th 1969	
Microorganisms	s	h	s.h	h	s.h	h	s.h	h	s.h	h	s.h	h	s.h	h	s.h	h	s.h
Tetramitus pyriformis	4			1	4												
Trigonomonas compressa	4			1	4												
Actinosphaerium echicornii	2,5	3	7,5											3	7,5		
Amoeba radiosa	2,5															1	2,5
Chilodonella cucullulus	3							1	3								
Metopus es	4									1	4						
Coleps hirtus	2,5	1	2,5					1	2,5								
Stylonichia mytilus	2,5	1	2,5														
		22	55,5	20	75,5	21	76	30	88,5	29	68	29	64,5	36	77	17	61,5
Biological evaluation																	

TISCIA /SZEGED/ 6, 1970-71

FROM THE LIFE OF THE CO-OPERATIVE

A Conference on the Subject of Tisza-research

According to the decision of the Committee for Tisza-Research, on April 6th, 1970 a research Conference was held. Its aim was to provide opportunity for the investigators functioning in the more remote areas of the country to present the results of their researches and to discuss them, getting on with coordinating the detailed tasks within the scopes of topics of complex character.

At opening the session, Professor Imre H o r v á t h welcomed the present members of the Co-operative and guests, giving the broad outlines of the results achieved in the year before and giving a detailed information on the research activity of the following period. Accordingly, the main purpose of 1971 is the fact-finding biocoenological investigation and fixation of the area of power basin II of the Tisza before the inundation area of largest extension in the Tisza basin will have got to the watery grave. Another task is to study the ecological factors of the fixed areas of biocoenoses indicating the effect of inundation before its taking place, connected with measuring the bio-mass production in some separate cases. He emphasized the importance of functioning of the meteorological stations to be established in the vicinity of the fixed areas for measuring the local climate.

The programme of the Conference was as follows:

1/ D o n á s z y, E.: Complex investigation of developing the fish production.

2/ A n d ó , M.: Natural-geographic conditions of the Tisza-reaches /power basin/ at Kisköre.

3/ U h e r k o v i c h, G.: Sapro-biological conditions of the Tisza and their effect to be expected on river barrage II of the Tisza.

4/ H a m a r, J.: Limnological investigation of the backwaters in the neighbourhood of Tiszafüred.

5/ B o d r o g k ö z y, Gy.: Synecology of the marshland-coenoses of the inundation area in the neighbourhood of Tiszafüred.

6/ T ó t h, M á r i a: Phytocoenoses of the parts of the Maros in Hungary.

7/ G á l, D.: Rhizopod fauna of the Tisza.

8/ B á b a, K. - F e r e n c z, M a g d o l n a: Animal populations of the stone spurs of Tisza.

9/ M a r i á n, M.: Ecological conditions of the sand martin /*Riparia riparia*/ settlements at the Tisza bed.

10/ L e g á n y, A.: Ornithological observations in the inundation area at Tiszafüred-Kisköre.

11/ N e m e s, I.: Experiments for introducing birds in the choice aspen plantations in the inundation area of the Maros.

12/ C s i z m á z i a, Gy.: Mammalogical investigation in the area of river barrage II of the Tisza.

Short abstracts of the lectures and discussion

D o n á s z y, E r n ő:
Complex investigation of developing the fish production /1969-1974/, tasks of the programme in connection with the Tisza research.
The Department for Scientific Research of the Ministry for Agriculture and Food Supply /M.E.M./ gave the Experimental Research Station for Fish-Breeding /Szarvas/ a commission for preparing a five-year research programme, on August 18th 1969.

In the programme, the investigation of the fish fauna of the Tisza-reaches above the river barrage of the Tisza at Kisköre obtained an important role. It is a very considerable duty to design and prepare in the most up-to-date way the formation and piscatorial exploitation of the fish fauna in the ten thousand hectare power basin to be established after building the river barrage.

The following preparatory works are to be performed until 1972:

1/ The composition of the fish fauna between Tiszalök and Kisköre, the alimentary conditions of fish, the factors exerting an influence on their essential conditions, among them the effect of water pollutions and the migratory circumstances of a number of marked fish placed into the Tisza are to be measured.

2/ The establishments needed for developing the fish fauna in the artificial lake of ten-hectare surface are to be designed. Settlements for young-fish breeding and rearing, fisherman's settlements. Also a research basis functioning with a harmonized scope of tasks /is belonging to these, for observing the conditions of the whole area, the development of the fish fauna and for furnishing due informations on data important for the coordinated settlements.

3/ In 1970 a committee is to be brought about for preparing an operative design for arranging fishery in Tisza II. The committee is composed by the fishery co-operatives and other interested institutions and by the representatives of the Research Station for Fish-Breeding, having for task to arrange fishing in Tisza II.

4/ The operative connections between the organs interested in the research work, e.g. the laboratory of the Management of Water Conservancy of the Middle-Tisza-Region, the Tisza-Research Committee in Szolnok and possibly other organs, as well, are to be arranged by Project Collective 1 of the research programme /Breeding Biology - Fishery Biology/.

Contributions to the discussion:

G á l, D.: The decrease of the stock of fish is, at least partly, a consequence of the reduction of the number of spawning-grounds. The fish spawns in the holes of inundation areas. If the developing young fish cannot get back into the Tisza because of the water recedence, it sticks in the hole and after its drying up it perishes. The problem could be solved by establishing suitable connections between the Tisza and the holes.

H o r v á t h, A.: After the Tisza being controlled, its stock of fish has decreased very much. Earlier the fish used to spawn in the warm riparian shallow water of rich vegetation. As a result of the water control flowing has become faster, the water vegetation with flowers disappeared. Then three kinds of possibilities have remained. If in the time of spawning the Tisza does not reach the water holes in the inundation area, spawning fails to come about. If it reaches the holes but recedes comparatively fast, the fish spawns in the hole but the offspring sticks in the hole and perishes. It is rendered possible by the water-level but rarely that the required quantity of young fish could get into the Tisza from the holes of the inundation areas. These holes are small and their number countless. It seems therefore hardly solvable to bring about connections between them and the Tisza for promoting the spawning of fish. It would be a better solution to set up such connections between the backwaters and the Tisza. The stock of fish is, anyway, threatened by the industrial pollution of the Tisza, as well. He raises the question, what the clearing helps against pollutions.

H a m a r, J. answering: According to a new order, the penalty to be paid for pollution is progressive, it may reach the amount of more million forints. As long as there are no suitable purifying plants, the factories are obliged to allot the amount of penalty for creating such plants. To-day it is already disadvantageous from the point of view of the factories to pay penalties instead of creating purifying plants. Nevertheless, suitable purifying plants are still generally missing. In the neighbourhood of Szolnok, for instance, there isn't any such plant functioning in a satisfactory way.

S z i t ó, A.: The siltation of the Tisza-bed is similarly unfavourable for the natural increase of fish. For instance, the multiplication of sturgon is influenced very unfavourably by that. Nonetheless, the purification of rough pollution may be solved.

A n d ó, M i h á l y:

Natural-geographic conditions of the Tisza-reaches /power basin/ at Kisköre

Any up-to-date agricultural production is characterized by its being more and more industrialized. The same holds true also in respect of the economy of water-supplies in connection with agriculture. It cannot be considered as a merely technical activity, being rather an intervention into the water balance of nature and an organic part of the industrial and biological process of agricultural production. The aim of irrigation, inland drainage, complex arrangement of river-basins is equally, to maintain optimum water conditions for the plant cultures by applying jointly the technical, biological, agrotechnical instruments. For increasing the agricultural output, we need the proportional contribution of the areas, as well, where the major improvement of the conditions of production can only be solved by the artificial supply of the missing precipitation.

The middle Tisza-basin and its environment is one of the areas where in the years rich in precipitation and in the humid ages inland water-damages are caused by the abundance in water; in the average of many years, however, the greater lag of crop is caused by the scarcity of water /drought/.

As to the yearly development of the relation between evaporation and precipitation, we have to face a negative water-balance in the mentioned area. On the basis of values of several years, there appears about 150-160 mm yearly scarcity of water. In the average of forty years, in the middle part of the Great Hungarian Plain, the annual precipitation is not more than 300 mm in the growth season. The index of claimed irrigation, that is a quotient of the possible evaporation and of the real mean annual precipitation, is here the highest one as compared to other regions of the country /about seven million cadastral yokes/. The artificial supply of the missing precipitation in the middle part of the Plain is justfied by this fact, as well. We have anyway to provide for water for a major territorial extension of the irrigation. It is important that the water supply for irrigating large areas is available in territories, as well, where the water requirement is even to-day not met by the balance of the need of water and natural water output.

The problem of water supply for irrigating the middle area of the Plain is to be solved by the barrage in the Tisza at Kisköre and its water-basin. The building of the river barrage at Kisköre is a complex establishment of water supplies that is an organic part even of the national blueprint of water management /Tisza-canalization/. Its primary destination is to reduce the water famine that is increasing in the Tisza-basin limiting the development of agriculture; simultaneously, to develop the industry and to meet the water requirement of the settlements along the Tisza.

Contributions to the discussion:

M a r i á n, M. is inquiring for the galery-woods being cleared.

H o r v á t h, A. is asking if the danger of inundation is ceased as a result of river barrages.

A n d ó , M. answering: The water-basin does not cause any rise in the underground water-level, nor any water-fluctuation: the Tisza becomes a river of canal-character. Instead of deforestations there are rather to be expected afforestations, planting of lines of trees against wind.

U h e r k o v i c h, Gábor:

Sapro-biological conditions of the Tisza and their effect to be expected on river barrage II of the Tisza

The Tisza gets to the tarritory of our country in o-ß-mesosaprobic average condition. The first maior population is induced by the Bodrog /cellulose factory at Hencovce/. The next problematical points are the mouth of the Sajó /Ózörény and the industrial area in Borsod/ and the loading by the industrial works at Tiszapalkonya-Szederkény. The third place like these is the joint load of the Zagyva and of the industrial establishments in Szolnok. The fourth place of major loading is Szeged where, in addition on the pollution of the hydrocarbon-field, saprobity is increased first of all by the higher number of the resident inhabitants. /The town sewage-waters are, after the synthetic detergents coming into general use and the households being generally chemicalized, no more so "innocent" ones as before. Similarly, after increasing the chemicalization of agriculture, the saprobic character of the drainage from such an area has changed, as well/.

At the greater loading points mentioned, the total saprobiological picture is temporarily shifting towards the α-mesosaprobic domain. In the intermediary reaches, owing to the suitable activity of self-purification of the river, the ß-mesosaprobic state is again re-established.

The 400 million cubic meter water-basin of the Tisza II barrage that

is to be made will generally be supplied with β-mesosaprobic water /water-quality class II/ by the river. Nevertheless, there will occur some difficulties as to the water quality that are to be reckoned with, from the beginning.

One group of the difficulties - to be discussed in details - is a result of that the limnological development of the pollutions touching the barrage immediately /Sajó, Tiszanalkonya-Szederkény/ will differ from the present ones pouring into a non-impounded reach.

Another group of the difficulties - to be discussed as well in details - will exist only for a transitional one-two years long period, owing to the fact of inundation of the flood area.

A third group of the difficulties will be derived from the fact that the water-basin will be in many places of shallow enough water.

Contributions to the discussion:

H a m a r, J.: asks if the locality of the major polluting effects remains, and if the water-basin is to be expected to be stable.

Z s o l t, J.: establishes that the problems of water pollution have a world-wide interest; the Tisza-investigators had to draw the attention of those competent to deal with them to take these problems more into consideration.

V e t r ó, J.: is mentioning that there are still a lot of problems as to the defence against the pesticides and detergents that are noxious to our health. The Station of Public Hygiene and Epidemics /KOJÁL/ offers aid, resp. co-operation, mainly in bacteriological respect, to the Tisza-investigators, especially in harmonizing their future plans.

B o d r o g k ö z y, Gy.: is suggesting that the results achieved so far by the "KÖJÁL" in connection with the Tisza-research should be published in the Tiscia. He is asking how much time is necessary after a major pollution for re-establishing the state of blance.

U h e r k o v i c h, G., answering: The collaboration in the affairs of water protection ought to be organized in the same way as in Szolnok. In case of the Tisza barrage, the alga-coating of the macrovegetation plays a great part in the self-purification. The effect of the pollution-wave is from time to time the result of time and distance /0.5-5 days/.

H a m a r, J.:

Limnological investigation of the backwaters in the neighbourhood of Tisza-füred

Of the backwaters of middle reaches of the Tisza the different degrees of siltation are characteristic. The siltation of backwaters is influenced by the inundation of the Tisza, by the water vegetation perished in the backwaters, as well, as by the fact that most of them have some independent water areas. Their water is chemically pure, dominated by Ca, Mg, and HCO_3 ions. There is but a small difference between the chemical compositions of the inner /mostly shallow open-water/ regions and the riparian parts of the backwaters. Mainly the values of pH and free CO_2 differ. On the free water surfaces the species characteristic of open waters live /*Ceratium*, *Peridinium*, etc./ Of the alga association the low species number and high individual number is characteristic /Summer data/. There is a complete change in the algological picture in the parts of the backwaters grown in by a floating and submerging water vegetation: *Nymphoidetum peltatae* /A l l o r g e, 1922/, *Trapetum natansis* /M Ü l l e r - G i z s 1960/, *Nymphaeetum albo-luteae* /N o v i n s z k i 1928/. Here predominate *Conjugatae* and *Euglenophytes*, and the high species number and low individual number is characteristic of the

alga association. The algological picture is highly similar to that of marshlands. A similar result was obtained by J. M e g y e r i at investigating the mesozooplankton.

In the riverside reeds /*Scirpeto-Phragmitetum* schoenoplectosum /Soó 1928/ there predominate the perphyte algae, first of all the diatoms.

From among the rare algae there are worth mentioning: *Surirella ovata* var. *pinnata* /W. S m. /, *Synedra arcuatus* var. *subrecta* C l e v e A., *Synedra paracitica* /W. S m ./, *Navicula cuspidata* var. *hankae* f. *craticularis* S k v., found in the so-called long reach /"Hosszu böge" /.

Contributions to the discussion:

B o d r o g k ö z y, Gy. is considering the above address as a good example of that important questions can be met by a reply only after investigating the water biocoenoses not separately.

U h e r k o v i c h, G. is holding as decisive to repeat the investigations. The separation of the main types on the basis of the macrovegetation allows of getting on with dividing the sub-types of microvegetation.

V ö r ö s, L. is taking for necessarily to draw also the groups Cladocera and Copepoda into the investigation.

H a m a r, J., answering: He is proposing the further systematic continuation of investigations /in Winter, as well/.

B o d r o g k ö z y, Gy.:
Synecology of the marshland-coenoses of the inundation area in the neighbourhood of Tiszafüred.

One of the largest and, at the same time, nicest part of the inundation areas along the Tisza is that at Tiszafüred. Its variegated vegetation conditions are brought about first of all by the level differences of the inundation area. The rich long reed-grass vegetation of the backwaters of different ages was reported by me in one of the Tiscia volumes.

Zone of the marshlands following the *Magnocaricion*. The composition of its vegetation is determined by the hydrographical conditions of the inundation area. And that depends, on the other hand, first of all on the flood-waves of the living water in the Tisza, of their frequency and degree. It can be explained by that that the frontier of the single vegetation zones - mainly in the relation of *Magnocaricion* and *Agrostion* - often changes.

Condition of coenoses. The marshland investigated may form even more associations within the *Agrostion* federation. The most frequent one is, anyway, here too - as anywhere else along the Tisza - *Alopecuretum pratensis*. Its differentiation within the association is determined by the peculiar soil and hydrographic factors. Their composition has shown a considerable change even in the course of the investigations carried out for more years.

In the years when the marshlands get inundation water repeatedly in more waves /the most frequently in February, April, and possibly August/, larger fields with stagnant-water become permanent in the inundation areas and the expressedly hygrophilic species predominate and form facies. In these years, the largen extension is achieved by *Alopecuretum pratensis caricetosum gracilis*. Its facies are: *Typha latifolia*, *Gratiola officinalis*. The meadow foxtail /*Alopecurus* sp./ is driven back by these in a high degree. In the years forming a more humid period when the inundation area gets under water usually only in March or April once or possibly on two occasions, and the flood quickly passes, *Alopecurus pratensis* again becomes dominant. Some species of great ecological adaptability - as differential species - are similarly distributed and the subassociation *Alopecuretum pratensis poetosum angustifoliae* becomes dominant, together with

the species *Symphytum officinale, Tragopogon orientale, Trifolium hybridum,* as well as *Gentiana pneumonanthe,* by threads.

The marshlands along the Tisza are rather poor in species in the vicinity of Tiszafüred, as well. That may be explained mainly by the yearly repeated silting up and, as a result of that, by the unfavourable soil-ecological effect of the young pouring soil.

Contributions to the discussion:

A n d ó, M. is asking if the zonality of plant associations as a result of the growing distance from the Tisza can be demonstrated: and what kind of change is caused by the pouring becoming soil.

B o d r o g k ö z y, Gy., answering: There cannot be observed any change as we depart from the Tisza. As the soil formation makes a progress, the associations become richer in species.

T ó t h, M á r i a :

Phytocoenoses of the inundation area of the Maros

Period of the investigation: 1964-1966 /part in Hungary/, 1969 /part in Rumania: Nagylak-Lipova/.

The breadths of bed and inundation area are changing but showing a zonal picture on the basis of the surface, soil and agricultural conditions. That is reflected by the plant associations, as well.

I. Bed-associations /periodical, changing ones/.
II. Associations in the inundation area:
1. Associations with grass included:
Alopecaretum pratensis hung.
Cynodonti-Poëtum angustifoliae
Astragalo-Festucetum sulcatae danubiale
2. Plough-lands, orchards:
Consolido orientali-Stachyetum annuae
Echinochloo-Setarietum
Digitario-Portulacetum
3. Gallery-forests: *Salicetum albae-fragilis*
Fraxino pannonicae-Ulmetum

III. Holes in the inundation area:
Scirpo-Phragmitetum
Polygono-Bolboschoenetum
Bolboschoenetum maritimi continentale

IV. Dams:
1. Lower, wet part: *Alopecuretum pratensis* hung.
2. Middle, drier parts:
Cynodonti-Poëtum angustifoliae

Astragalo-Festucetum sulcatae dimbiale

Arrhenatheretum elatioris /derivative type on the Northern side/

3. Dam crown: *Sclerochloo-Polygonetum*

Lolio-Plantaginetum majoris

Reporting on the most characteristic associations, with special regard to the regularities of the appearance of montan elements.

Contributions to the discussion:

B o d r o g k ö z y Gy., is asking if the performed soil researches concerning the *Polygono-Bolboschoenetum* associations.

U h e r k o v i c h, G. has noticed that the role of the Maros in the species distribution is increased because it is a faster river.

A n d ó, M. has asked if the percentage of the Mediterranean species is higher along the Maros.

T ó t h, Mária, answering, lets known that she had not performed any soil research and has no exact data about the participation of the Mediterranean species.

G á l, DAniel;

Rhizopod fauna of the Tisza reaches in Hungary and of the mouth part of its tributaries

I have collected for the last ten years from the different parts of the Tisza and from the mouth parts of its tributaries 827 plankton, silt, and scrape samples for ascertening how the Rhizopod fauna of the Tisza changes at different places and different dates and how that change is influenced by the tributaries.

The most important results are as follows;

1/ There came to light from the Tisza and its tributaries 69 Rhizopod taxons.

2/ In the planktons *Rotatoria* and *Entomostraca* species predominated.

3/ *Rhizopoda* can be found in the Tisza and its tributaries but with a low number of species and single organisms, the most wide-spread species being; *Arcella rotunda* var. *aplanata* D e f l., *Centropyxis aculeata* S t e i n, and *Cyphoderia margaritacea* E h r b g.

4/ The mouth part of the tributaries is generally poorer in species number, but mostly much richer in the number of single organisms, than the Tisza reaches at the mouth of the tributary.

5/ The tributaries do not exert any well-demonstrable influence on the Rhizopod fauna of the Tisza concerning either the number of species or that of single organisms.

6/ From among the species found, only *Vahlkampfia debilis* J o l l o s is a really river-water species, the others are comsonolite, still-water species of mosses and *Sphagnumdwellers*.

7/ From the Tisza and tributaries I have described a new species: *Euglypha tisciae* G á l.

Contributions to the discussion:

G á l, D.: Abouth the Rhizopod fauna of the Tisza.

H o r v á t h, A. is establishing that, on the basis of the lecture, there manifest themselves remarkable differences between the fauna of the Tisza and that of its tributaries. It would be most desirable to establish the cause of differences.

A n d ó, M. is asking if it is a connection between the faunas of the Kraszna and the marshland at Ecsed.

K i s s, K. is mentioning that in June the *Euriglypha tisciae* was found in the Eastern Main Canal, as well.

M a r i á n, M. is asking if a somewhat more exact quantitative sample collection than that reported on could technically be performed.

S z e m e s, G. is mentioning that the Rhizopod fauna is very important also for qualifying the waters, its investigation being, therefore, absolutely necessary. He is pleased to see the development of the complex character of the Tisza research. He is deeming desirable to develop the complex character of researches and omit any self-centredness in the future, too. The natural history is to be investigated as depending on the water-level, as well. He is congratulating the Co-operative of Tisza Investigation on its results achieved so far.

G á l, D., answering, establishes that it is definitely shown by his investigations that some Rhizopod species do occur only in the tributaries and in the Tisza they can only be seen in the vicinity of the mouth of tributaries. He has studied also the ecology of the single species but his data relating to the subject are not sufficient, as yet, for demonstrating the cause of differences. He has found some differences also between the fauna of the single tributaries. For discovering the possible connections, it is also necessary to investigate the adjacent backwaters and marshlands. At his quantitative investigations he cannot apply larger sample-volumes because of the plankton-net being filled.

B á b a, Károly - F e r e n c z, Magdolna:

Investigations on the riverside stones of the Tisza

The authors were investigating the dependence of construction and localization of the animal coenoses settled on the riverside stones of the river Tisza upon the drift speed /July-August, 1969/. The collections of coenological character were carried out in depths of 10-30 and 50-120 cm, taking into consideration the flow conditions. Our analysed material was deriving from the opposite riversides of the Tisza-reaches of Kisköre, Öhalász, Tiszaörvény at the Middle-Tisza and Vásárosnamény at the Upper-Tisza. The collecting stations were compared with one another on the basis of numbers of the species-dominance-constancy, by applying Ramsey's formula. The results were checked by means of significance reckoning.

Our establishments are: the majority of the 27 species found in the collecting stations of the Middle- and Upper-Tisza have been: *Mollusca, Ephemeroptera, Trichoptera* species. The leading species of the synusia at the Middle-Tisza have been: *Lithoglyphus naticoides, Dreissena polymorpha, Heptagenia sulphurea, H. flava, H. lateralis, Hydropsiche angustipennis, H. instabilis, Cheumatopsiche lepida*! and at the Upper-Tisza: *Caenis lactea* and *Polycentropus flavomaculatus*. Between the coenoses living in the shallower and deeper waters, as well as those of the Middle- and the Upper-Tisza there is no identity of species /B á b a' s publication, 1968/. The synusia found in both water levels vertically differ in species-composition and structure, according to the drift speed. At the riverside sectors of stronger drift, in addition to the constant *Heptagenia sulphurea* and some of the enumerated *Trichoptera* species, there appear the *Theodoxus transversalis, Ecdyonurus venosus, Caenis macrura* species. The losing speed is shown by the appearance of the *Heptagenia flava, H. lateralis* and mullusks as constant species besides the *Triptochera* species, as well as that of *Caenis lactea*. The losing speed leads to an increase of the number of species of high characteristic and that of the total number of single organisms. The synusia in the shallower water at the Middle-Tisza may be contracted into the socion-category *Heptagenia lateralis - Hydropsiche angustipennis*.

Contributions to the discussion:

M ó c z á r, L. is suggesting to get on with collecting the data and to develop the collections more broadly in time. In his opinion, a proper picture of the animal kingdom can only be obtained by systematic collections prolonged to every season. The dynamics of biocoenoses could be investigated in this way, on a pragmatic basis.

H o r v á t h, A. is considering the investigations as promising to be successful. Anyway, there were so far found in the single collecting stations but few single organisms and for a reliable coenological statistics there would be needed several data. He is enumerating some species that - as he knows it from experience - are frequent on the stone dams and were not mentioned in the address. He is asking if they were really missing in the area investigated. He is perticularly wanting the occurrence of *Gammaridae*.

V ö r ö s, L. has noticed the absence of *Grammaridae*, as well. The samples may have been collected possibly in such a way that the *Gammaridae* were omitted.

B á b a, K., answering: The deficiencies mentioned may indicate the pollutions carried by the flood in the Tisza. In the time of investigation they did not find a number of species that had been demonstrated there before. For deciding this problem it is necessary to perform further investigations. In case of these investigations, he suggests, too, to measure the drift speed of the river.

M a r i á n, M i k l ó s :

Econological conditions of the sand martin /*Riparia riparia L.*/ settlements at the Tisza bed

The author outlines his investigations concerning the sand martin, continued by him for six years as the first detailed investigations in that direction in Hungary. Moving on from the mouth of the Tisza towards the river-head, he has carried out so far in 600 river km the quantitativ recording and survey of the colonies. He wants to clarify the dynamics of

population changes in the way of ringing that is being performed more easily than expected before. Last year he began to investigate some colonies ethologically, as well.

Picking out a detail from the results of his ecological investigations, he is demonstrating in which way the formation of the colonies, resp. of the hatching holes within them, is influenced by edafical factors.

In the Tisza bed a precondition of the formation of colonies is a steep river wall without any vegetation. In about 90 per cent of riversides like that the sand martins settle down.

The direction of the site of river walls as compared to the four quaters of the world, in contradistinction to the experiences in case of bird species building their nests in hollows in a tree, does not exert any influence on the settlement of sand martins. The structure of colonies is other one in sandy or loess clay walls than in loess walls.

After digging out and surveying the settlements in details, it can be established that the ducts of the nesting hollows decline from the plane of the front wall, obviously and in the overwhelming majority of cases, in the same angle /65-80 degrees/.

The almost thoroughly staight course of the ducts is similarly striking. Both latter phenomena are explained by the investigator with the peculiarities of the organism of birds, resp. with the technique of hollow-digging.

Contributions to the discussion:

K e v e, A.: In the Tisza-research also an intensive investigation of the avifauna is necessary. That is verified also by the lecture delivered. Although the sand martin does not live in water, owing to its habit of life and the choice of its hatching site it cannot be separated from the natural history of the Tisza. He considers necessary to get on with investigating that topic and is suggesting to extend the bird-ringing observations in as wide limits as possible.

N e m e s, I. is asking, what percentage of the hatching hollows are occupied, what percentage of brood perish,during hatching resp. in what percentage of cases new hatchings take place.

M a r i á n, M. is answering that about fifty per cent of the hatching hollows are dwelt but he has not enough data for establishing the percentage of perished birds.

L e g á n y, András:

Ornithological observations in the inundation area at Tiszafüred-Kisköre

Because of the work of man transforming the nature the interesting fauna and flora of several territories perish. Our task is recording as much as possible of the natural history of these territories still before

these changes will have taken place. The territory demarkated by the line of Tiszafüred-Abádszalók-Kisköre-Poroszló belongs to this category. My aim was to investigate the avifauna. Therefore, I have made recordings according to biotopes - inundation woods, willow-plantations, inland aspen-plantations, choice poplar-plantations, acacia groves, ash-woods, meadows and pastures - by means of which I have endeavoured to clarify the quantitative and qualitative relations of the fauna and, of course, even more for obtaining significant results.

I have established that the area is composed of the mosaics, mosaic complexes of the biotopes. The dominance of xerophilic elements is characteristic, as opposed to the hydrophilic species. The area, being a woodland, is prosperous to the arbicolic species, although the birds hatching in the tree-trunk and shrub stratum are represented, as well, in a considerable percentage.

It is necessary to analyse in details the role of avifauna for clearing up - after investigating the quality of the food used up and reckoning the weight dominance - the very important role played by the birds in maintaining the biological equilibrium and in the biological protection of woods and of the adjacent agrarian areas.

Contributions to the discussion:

B e r e t z k, P.: The coincidence of the crow and heron colonies is here a consequence of the pressure of necessity that is to be explained with the lack of nesting places.

M a r i á n, M. is interested in quantitative data. He is asking if the rooks in the number observed by the speaker can be considered as useful or noxious in the investigated area.

L e g á n y, A., answering: He did not go into the details of more exact quantitative conditions, for lack of time. He is considering the rooks in the area of his investigations as agriculturally noxious in their present number.

N e m e s, István:

Experiments for introducing birds in the choice aspen plantations in the inundation area of the Maros

I have carried out my experiments in two biotopes from 1967 until 1969. The age of trees in both biotopes is 13 - 14 years.

Biotope I: An area surrounded by a Summer dam providing a safe protection even against major inundation of the Maros. It has a stand of tree species that are of second quality from the point of view of forestry, weak and badly developed. The extent of wood area is 1 x 1 km.

Biotope II: Generally inundated area. An excellently developed, dense, narrow tape-wood, with thin insect population on the ground level.

My experiments have been carried out with standard holes made of wood and asbestos slate /types A,B,C,D/.

In the course of my experiments so far six bird species settled down: *Parus major* L., *Parus caeruleus* L., *Passer montanus* /L/, *Junx torquilla* L., *Sturnus vulgaris* L., *Phonicurus phoenicurus* /L./.

The most important influencing factor of the bird establishments is the river Maros.

In the first year of my investigations the inundation area of the Maros, except biotope I, was covered with a very high flood, until the end of May. Then I observed here the establishment of highest proportion, in respect both of the number of species and that of single birds. Anyway, also the successful nesting was disturbed the most, just in that time, by the struggle for hollows and by Mustela n.nivalis. In the following years the adjacent area was not inundated by the Maros therefore, owing to the more and more enriched insect population, the number of nesting species decreased, as well.

Biotope II, except *Junx torquilla*/L./ and *Phoenicurus phoenicurus* /L./, has similarly proved to be suitable for bird establishment.

Contributions to the discussion:

C s i z m a z i a, Gy. is asking if the author has observed any harm by mammals and bat-establishment in the artificial holes.

B o d r o g k ö z y, Gy. is asking if the occupation of the holes by sparrows could be prevented by making hole-apertures of smaller diameter.

N e m e s, I., answering: He has observed neither any dammage by mammals nor the establishment of bats. In the area investigated by him there are not living any mammals /e.g.,red squirrels/ that were harmful from this point of view. We have to promote the rapid breeding of useful birds by means of artificial holes. He is admitting, to be sure, that the occupation of holes by sparrows makes difficulties.

C s i z m a z i a, György:

Mammalogical investigation in the area of river barrage of the Tisza

The investigations were carried out in the area of Pusztataksony, Kisköre /1962/63/, in the inundation area of Kisköre, Sarud /1965/, in that of Abádszalók and Poroszló /1968/, as well as in the vicinity of Tiszafüred /1969/.

In the course of comparing the data of trappings to the hydrographical conditions it turned out that the life of mammals living in the inundation area and the regeneration starting from the back areas are decisively influenced by the height and duration of inundation waves. B a u e r /1956/ and F e s t e t i c s /1959/ described the fluctuation of the population of 6-7 years old small mammals in case of "population minimum" if connected with a great inundation wave. In that case, the regeneration of mammals in the inundation area takes only place in the following year /1962/. After inundation waves of average size in the inundation area between Kisköre and Tiszafüred, at the end of July, - in the course of migration - the mammalian fauna showed a complete picture again.

During the collections, observations there lived 25 mammalian species in the area.

H y d r o b i o n t i c group: *Lutra lutra, Ondatra zibethica, Neomys fodiens.*

H y d r o p h i l i c group: *Sus scrofa, Talpa europaea, Sorex araneus, Sorex minutus, Crocidura leucodon, Micromys minutus, Rattus norvegicus.*

H y d r o g r a d e group: *Vulpes vulpes, Mustela nivalia, Mustela erminea, Mustela putorius Martes foina, Capreolus capreolus, Lepus europaeus, Apodemus agrarius, Apodemus sylvaticus, Apodemus flavicollis, Mus musculus, Microtus arvalis, Erinaceus europaeus.*

X e r o p h i l i c group: *Citellus citellus, Spalax leucodon.*

After the barrage being finished, only the existence of mammalian species belonging to the Hydrobiontic group is guaranted, and even we may reckon with their rapid breeding.

At the building operations in progress at present, a great number of fossil mammal finds have been found but a part of them gets lost.

While so far the life of animals living in the area has been influenced the most decisively by the inundation waves, at present the human work /wood-felling and cutting, soil-work, etc./ results similarly in a strong transformation of the mammalian fauna /transmigration of the deer, hare removal of the ondatra settlements to other places, increase of the number of otters, etc./.

At present, quantitative and qualitative picture of the mammalian fauna of the area is changing from year to year and this process will last until the storing lake will have been completely filled up.

Contributions to the discussion:

U h e r k o v i c h, A. is suggesting to take into consideration the weather at setting the traps in their places.

H o r v á t h, A. is thinking that at evaluating the results of trappings we need some care. The mammal may not have fallen into a trap, only because it did not go to that place or had found the required food somewher else. In casts, the author himself found some species that he had not entrapped. The shrew-hunting by a tree with tinder fungus might have been more successful because the shrews had come to eat the insects living in the fungus. It is no sufficient evidence of the perdition of mammals in the inundation area that the traps placed to the riverside had remained empty. They may have escaped swimming and got the bank somewhere else. An animal making its escape from a sudden inundation is strongly under the influence of the instinct of flight; it is questionable whether or not it eats on that occasion.

G á l, D. is thinking that investigating the effect of inundation we ought to study, apart from the fate of the single species, also that of the populations.

B á b a, K. is raising the idea of labelling the small mammals.

M a r i á n, M. is mentioning his exnerience that the small mammals are not induced to a quick escape by a slow increase of water level; on that occasion there could be obtained proper data by trapping. He is asking the speaker if he trapped *Spalax hungaricus* in the area at Kisköre.

C s i z m a z i a, Gy. is answering that the result of trapping has not been influenced by weather in a decisive way. Feed can be observed even during escaping. He is dealing with the plan of labelling the small mammals. As to *Spalax hungaricus*, he could observe only its characteristic canal.

H o r v á t h, I.: Chairman's concluding words:

He is considering the Conference as a successful recording of their work, as to the number of participants and speakers, the intensive contributions and their content. He is asking to continue the enthusiastic work. They are going to discuss the plans of work in the meeting of the Committee for Tisza-Research before long, and forward the requests about the possible changes to the members. Moreover, he is asking to concentrate the investigations of that year are planned for the end of July in the sector of the Tisza II barrage. For the Committee for Tisza-Research a motor-boat is being made and is expected to be finished for that date. He is asking the researchers to use as exact methods as possible and to apply generally accepted methods in their fields of research.

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